A GRADED COURSE OF GEOGRAPHY

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BOOK II—SECOND YEAR

EARTH'S CRUST, LAND FORMS, AND PRIMITIVE COMMUNITIES

AUSTRALIA, NEW ZEALAND, AFRICA

BY

E. S. PRICE

GEOGRAPHY MASTER, RUABON GRAMMAR SCHOOL

CHIEF EXAMINER IN GEOGRAPHY TO THE JOINT MATRICULATION BOARD

R.A.N.M.'s High School (Main) No. 260 Date

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EARTH'S CRUST, LAND FORMS, AND PRIMITIVE COMMUNITIES. AUSTRALIA, NEW ZEALAND, AFRICA

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BY

E. S. PRICE

GEOGRAPHY MASTER, RUABON GRAMMAR SCHOOL
CHIEF EXAMINER IN GEOGRAPHY TO THE JOINT MATRICULATION BOARD

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GENERAL PREFACE

THE four books, of which the present volume is the second, form the basis of the four years' course in Geography which is in operation at one of the two schools receiving a special geography grant from the Board of Education.

In deciding to add yet another series of geography books to the number already available, the author was influenced partly by the opinions of inspectors and other experts who visited the school, and partly by the experience gained as lecturer on the teaching of geography at different summer schools, where manuscript copies of the work have been examined by hundreds of teachers.

The distinguishing features of the present course are:

(1) Educationally, geography is regarded as a practical science, therefore great prominence is given to individual work of a kind intended to stimulate the pupil's self-activity. The practical exercises have been framed to lead the pupil to discover and apply geographical laws and principles.

(2) The selection of descriptive matter and the mode of presenting it, is entirely in the hands of the teacher, who is free to follow his own inclinations.

(3) The special educational value of geography in linking together other studies is recognised, and useful connections are established between the various subjects of the curriculum.

(4) The books cannot be used independently of the teacher. They are not text-books. The pupil's text-book is his own notebook.

The course is intended for pupils between 12 or 13 and 16 years of age, and covers the outlines of the geography of the world by a successive treatment of the continents, which are dealt with in the following order:

Book I.—South America.

Book II.—Australia and Africa.

Book III.—North America and the British Isles.

Book IV.—Eurasia and revision.

This order of treatment was chosen because of the order in which the main principles of physical and human geography are emphasised. In the first year of the course the emphasis is laid upon climate and vegetation. In the second year the emphasis is upon land forms and the sculpturing agents. In the third year the emphasis is upon industries and trade. A simple geological map of the British Isles is introduced at this stage.

The principles established in the first year are reviewed and amplified as the course advances, and new topics are illustrated by examples drawn not only from the special regions which are under consideration, but also from regions already dealt with. Thus past work is constantly revised, and the pupil is led to realise that geographical principles are world-wide in their application, and this prepares him for the fourth year of the course, when he surveys the world with natural regions as units.

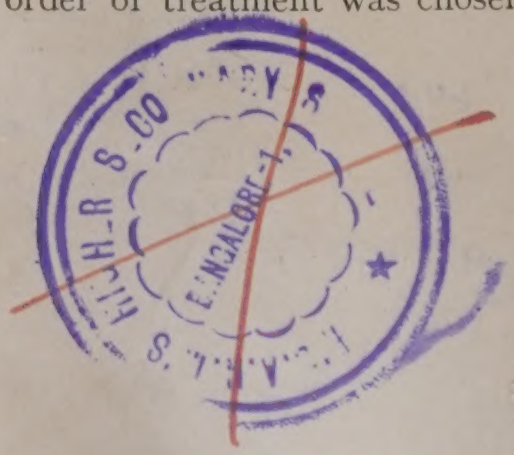
The success of the course depends largely upon the use which is made of local material. It cannot be too strongly urged that the pupil's mind should be brought into contact with actual facts. Direct observation of the physical conditions and human activities of the school district is essential for providing the imagination of the pupil with material for constructing pictures of conditions in other lands. These mental pictures should be expanded and corrected by means of pictures, lantern slides, and models.

The writer desires to record his great indebtedness to Prof. Fleure of the University of Wales, Aberystwyth and to W. Hammond Robinson, Esq., M.A., Inspector to the C.W.B., for constant inspiration and encouragement.

In planning the present course, he has derived considerable help from the numerous geography books which have been published during recent years.

E. S. PRICE.

GRAMMAR SCHOOL,
RUABON.



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PREFACE TO BOOK II

This book pursues the aims and methods set out in the General Preface. While reviewing and amplifying the principles considered in Book I, special attention is given to the earth's crust, to the agents which modify the earth's surface, and to the interaction between structure and relief and man's varied activities.

As in Book I, it is intended that the exercises marked **A., P., G.,** etc., should form part of the course to which each letter refers, and should be worked before the geographical exercises which follow. When this proves impossible, it will be necessary for the teacher of geography to include some of them in his course. the others must be omitted.[1] Of the remaining exercises, some are of a more advanced character and provide material for the quick workers.

Exercises prefixed by an *asterisk* are to be answered as a result of lessons given in class or as a result of independent reading. As the course advances, the pupil should be led to rely more and more upon his own efforts. He should be taught to consult books of travel, encyclopædias, and other reference books.

It is again suggested that the English Course should include such texts as *Mungo Park's Travels*, *Cape to Loanda* (Blackie's English Texts), and that in Welsh schools such a book as *Llwybrau Gwyllt y Congo* or *Anturiaethau Cymro yn Affrica* should be included in the Welsh course.

In the Appendix the teacher will find some hints on carrying out the work and a list of books for reference.

The writer again desires to express his great indebtedness to Mr. W. E. Whitehouse, M.Sc., of Aberystwyth University, for his invaluable help.

E. S. Price.
Grammar School,
Ruabon.
January 1922.

[1] **A.** Arithmetic ; **C.** Chemistry ; **E.** English ; **G.** Geometry ; **H.** Handwork ; **Hy.** History ; **P.** Physics.

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A GRADED COURSE OF GEOGRAPHY

BOOK II

SECOND YEAR

CHAPTER I

POSITION, LATITUDE, LONGITUDE, AND TIME

1. HOW many degrees are there in a circle? Notice that the equator, marked on the school globe, is divided into 360 equal parts, called degrees. If the equator measures about 25,000 miles, how many miles are there to an equatorial degree?

P. 2. You have learned in Book I that all circles which divide the globe into two equal portions are called **great circles.** Experiment with a ball to revise the following facts: (i) all great circles are equal, (ii) the equator is a great circle, (iii) the shortest distance between any two points on a globe is along the arc of a great circle passing through the two points.

3. On a rubber ball or slate globe mark the equator and two or three parallels of latitude and two or three meridians of longitude. By means of a piece of thread find (*a*) where the shortest distance between two places on the same meridian lies with respect to the meridian, (*b*) where the shortest distance between two places on the equator lies with respect to the equator, (*c*) where the shortest distance between two places on any other parallel of latitude lies with respect to that parallel (i) north of the equator, (ii) south of the equator.

4. Find the British Isles and Australia on the school globe and measure the approximate distance between them. To do this, stretch a piece of thread across the globe from the south-east of England to the north-west of Australia. Measure this distance in equatorial degrees by placing the thread along the equator and counting the number of degrees covered by the measured length of thread. Show your working in your notebook.

Measure also the distance from the north-east of Australia to the south-west of Ireland.

5. A ship leaves Southampton for Albany (Western Australia) via the Mediterranean, Suez Canal, and Red Sea. Find from the globe the approximate length of the journey.

6. Use a globe and a piece of thread to find the shortest distance from Australia to (*a*) Africa, (*b*) South America, (*c*) India, (*d*) New Zealand.

7. Enter the following in your notebook, and with the help of the globe and your atlas insert and underline the omitted words:

To the north-west of Australia lies the continent of , from which Australia is separated by the Archipelago. To the east of Australia lies the Ocean, which extends to the west coast of , a distance of about miles. The Ocean lies to the west of Australia, and the distance across it, to the east coast of , is about miles. New Zealand lies to the south-east of Australia, from which it is separated by the Sea. North Island is separated from South Island by Strait. New Guinea on the north is separated from Australia by Strait, and Tasmania on the south by Strait.

8. Copy Fig. 1 into your notebook and mark upon it as many as possible of the names found in your answer to question 7.

9. Copy the following table into your notebook and with the help of your atlas fill in the third column:

Latitude.	Longitude.	Town.
$37\frac{3}{4}°$ S.	145° E.	
35° S.	$138\frac{1}{2}°$ E.	
$23\frac{1}{2}°$ S.	$150\frac{1}{2}°$ E.	
20° S.	$146\frac{1}{2}°$ E.	
35° S.	118° E.	

***10.** Examine the meridians and parallels marked on the school globe and explain why one degree of latitude is approximately 69 miles

FIG. 1.

in all latitudes, while one degree difference of longitude is about 69 miles at the equator only.

G.D. 11. The approximate length of a degree of longitude at different latitudes may be found in the following manner: Draw the quadrant A B C (Fig. 2) making B C = 69 mms. Make the angle D B C = 10° and complete the figure by cutting off arcs equal to C D along A C and drawing parallels as shown in the figure. Measure the length of each parallel, and compare your results with the following table. One millimetre represents one mile.

APPROXIMATE LENGTH OF ONE DEGREE OF LONGITUDE

Latitude	Length in Miles.	Latitude.	Length in Miles.
0°	69	50°	44½
10°	68	60°	34½
20°	65	70°	23½
30°	60	80°	12
40°	53		

12. Enter the following in your notebook. Insert and underline the omitted words:

The mainland of Australia extends from lat. S. to lat. S., a distance of about

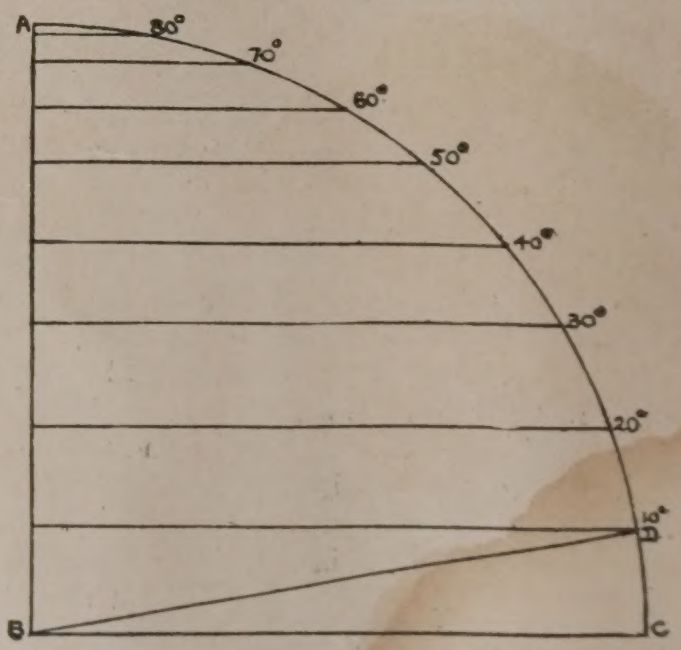

FIG. 2.

miles. It is almost bisected by the Tropic of . Parallel of lat. S. passes through Bass Strait. New Zealand lies between lat. S. and lat. S. The northern half of South Island lies in the same latitudes as the island of .

13. Fig. 3 is a graph showing the latitudes where the sun is in the zenith at noon. Find the dates at which the sun is overhead at noon at each of the following places: Rockhampton, Charters Towers, Port Darwin, and Cape York. Draw up a table showing the latitudes where the noonday sun is in the zenith on the first day of each month.

Latitudes where the Sun is in the Zenith at Noon

G. 14. Find the length of the noonday shadow of a 6-ft. pole at your school on March 21, June 21, September 21, and December 21, then draw four right-angled triangles to scale to find the altitude of the sun on the dates named.

15. In what direction does the midday shadow of a pole at the following places point: (*a*) the School, (*b*) London, (*c*) Melbourne, (*d*) Auckland, (*e*) Valparaiso, (*f*) Cape York, (*g*) Caracas, (*h*) Quito, in June and in December?

16. Place the school globe in a position where the sun may shine upon it. With plasticine fix three matches vertically on the globe (that is, pointing to the centre of the globe) at the points where three successive meridians cut the same parallel of latitude. Spin the globe slowly until the shadow of one of the matches lies along the meridian upon which it is placed. Do the shadows of the other matches lie along their respective meridians? Remove the matches and fix them vertically on the same meridian and spin the globe until the shadow of one of the matches lies on the meridian. Where do the shadows of the other matches lie with respect to the same meridian? At what time of day does the shadow of the school pole lie on the meridian?

17. Repeat the first part of exercise 16, but fix one of the matches on the meridian of Greenwich, one on a meridian east of Greenwich,

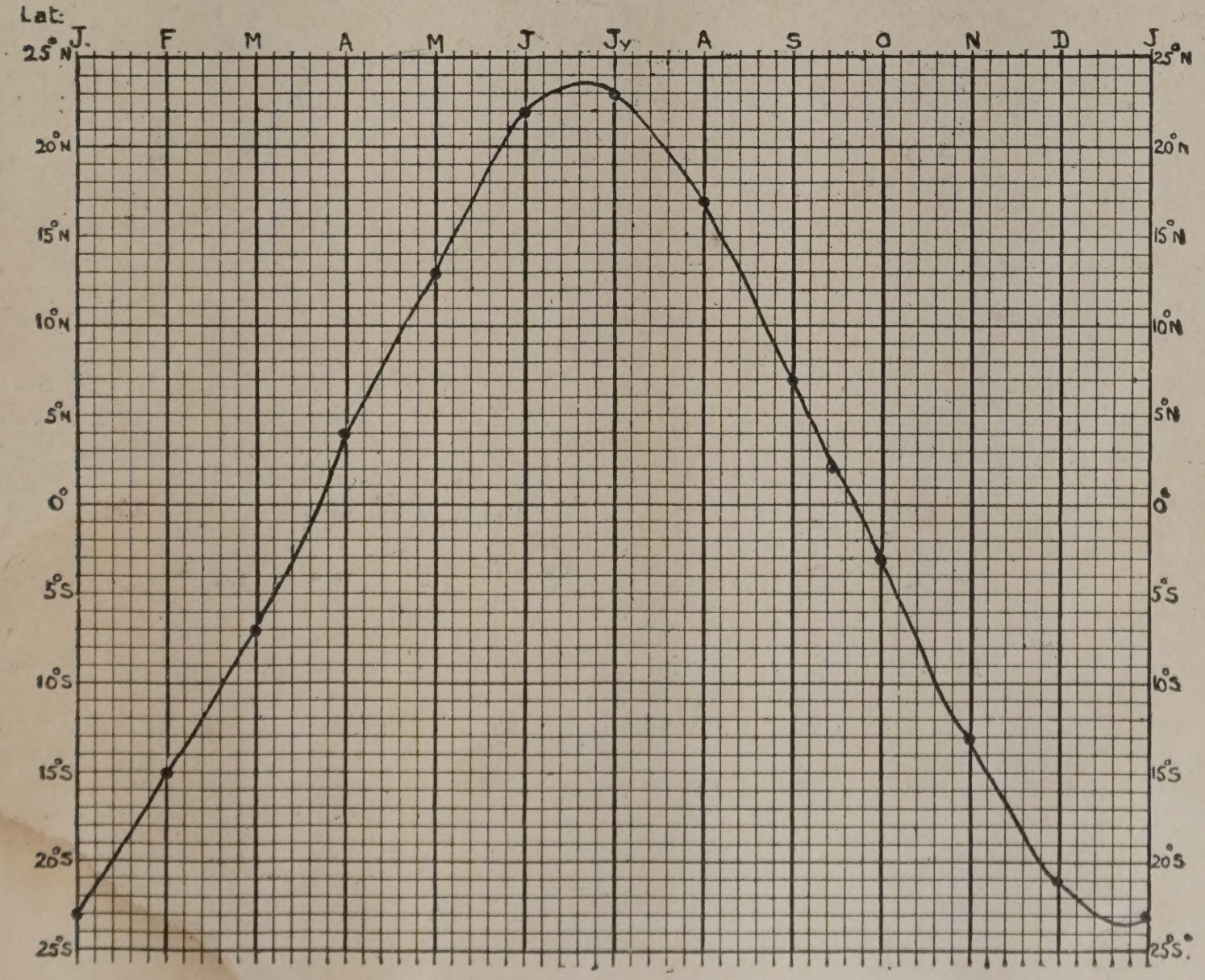

Fig. 3.

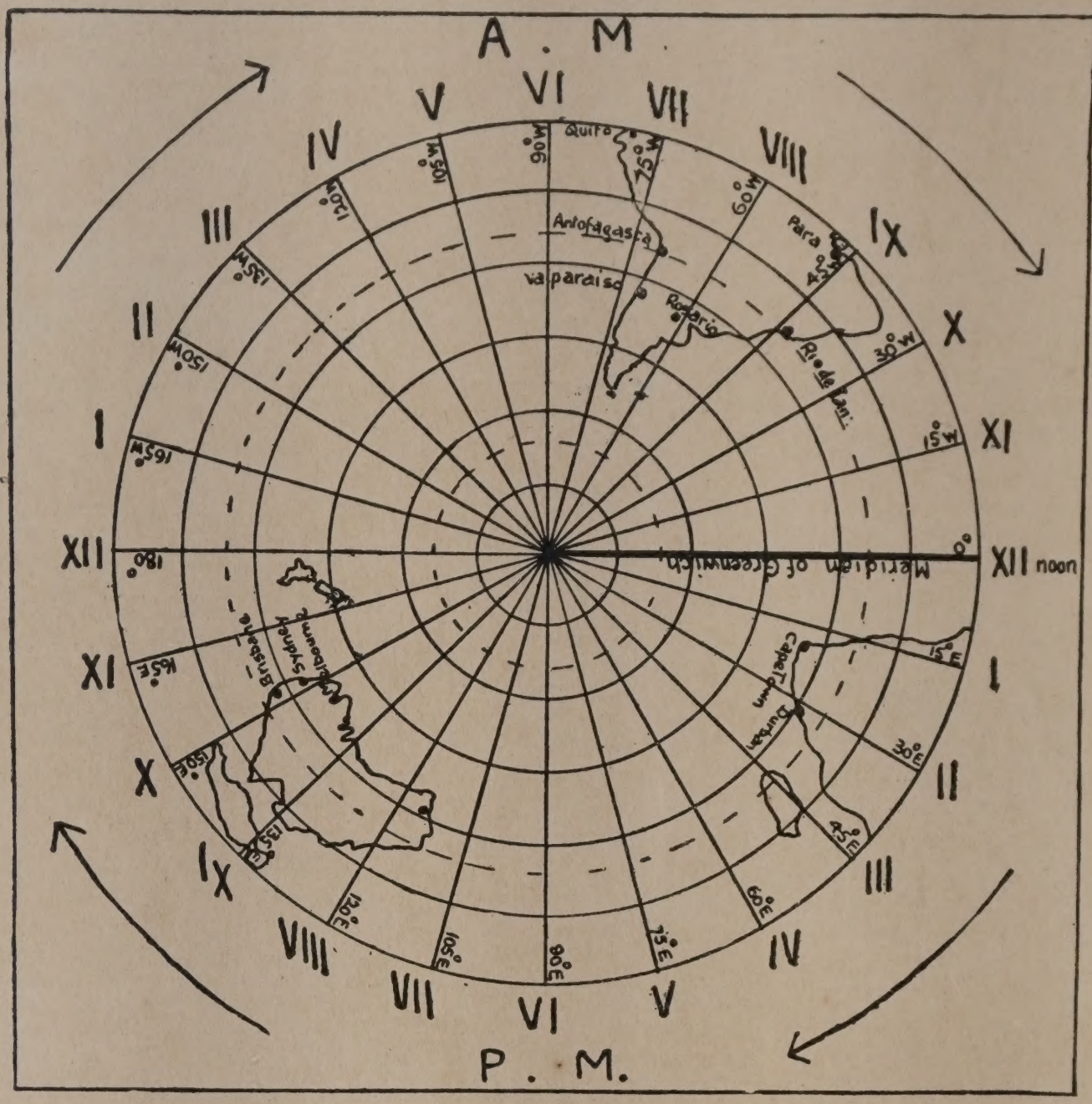

FIG. 4.

and one on a meridian west of Greenwich. Which has noon first—Greenwich, a place east of Greenwich, or a place west of Greenwich ?

18. Describe experiments with the globe to prove that places which lie on the same meridian have noon at the same time.

19. The earth rotates once in 24 hours. How long does it take to rotate through one degree ? Through how many degrees does it rotate in an hour ?

*__20.__ What is the longitude of the school town ? What is the time at school when it is noon at Greenwich ? What is meant by **Greenwich time** and **Local time ?** Give reasons why Greenwich time is observed throughout Britain.

H. 21. Construct a model to determine the time at places in the Southern Hemisphere when Greenwich time is known, from the following directions. On a thin sheet of cardboard copy Fig. 4. (The Roman numerals should be omitted.) Cut the cardboard along the circle. Now cut a square piece of cardboard of 5-in. side and find its centre. Place the circular card on the square card, and push a patent fastener through the centre of both cards. On the square card mark the hours opposite the meridians on the circular card as shown in the figure. Mark the meridian of Greenwich in red ink.

22. Find by calculation the time at Quito, Para, Antofagasta, Falkland Islands, Melbourne, Albany, and Brisbane, when it is noon at Greenwich. Use your model to check your answers.

23. Use your model to find the time at Greenwich when it is (*a*) 8 a.m. at Brisbane, (*b*) 5 p.m. at Sydney, (*c*) 10 a.m. at Valparaiso, (*d*) 9 p.m. at Rio de Janeiro.

24. Find the time at Sydney (long. 151° E.) when it is 10 a.m. at Perth (long. 116° E.) by calculation and by using your model.

25. Enter the following paragraph in your notebook. Fill in and underline the omissions :

Places which lie to the east of Greenwich have noon Greenwich, while places which lie to the west of Greenwich have noon Greenwich. Places which lie on the same meridian have noon . A difference of one degree in longitude means a difference of minutes in local time.

CHAPTER II

SCALES AND AREAS

1. SUPPOSE you have drawn a plan of your classroom to a scale of one inch to a yard, what fraction of the actual distance between two points in the classroom does a line between the same points on the plan represent ? If a map is drawn to a scale of one inch to a mile, what fraction of the actual distance does a distance measured on the map represent ?

Instead of saying that a scale is so many inches to the foot or to the mile as the case may be, the corresponding fraction, as found in question 1, is often used. This fraction is called the **Representative Fraction**, and the scale is thus stated: R.F. $= \frac{1}{12}$, or R.F. $= \frac{1}{63360}$, that is R.F. $= \frac{\text{Map distance}}{\text{Distance mapped}}$. The numerator of the R.F. should always be unity.

A. 2. What is the R.F. for each of the following scales : (*a*) 4 ins. to 1 mile, (*b*) 3 ins. to 1 mile, (*c*) 1 in. to 4 miles, (*d*) 1 in. to 10 miles, (*e*) 1 in. to 5 yds. ?

A. 3. What does one inch represent on a plan whose R.F. is (*a*) $\frac{1}{36}$, (*b*) $\frac{1}{120}$, (*c*) $\frac{1}{144}$?

A. 4. What actual distance does one inch represent on a map whose R.F. is (*a*) $\frac{1}{10560}$, (*b*) $\frac{1}{31680}$, (*c*) $\frac{1}{2500}$?

A. 5. On a map drawn to a scale of 6 in. to 1 mile the distance between two towns is 26·4 ins. What is the actual distance between them ?

A. 6. The distance between two towns on a map is $31\frac{1}{2}$ ins. The actual distance between them is $5\frac{1}{4}$ miles. State the scale of the map both in the form of a R.F. and in inches to the mile.

A. 7. The distance between two towns on a map is 8 in. What is the actual distance between them if the R.F. of the scale of the map is $\frac{1}{253440}$?

A. 8. The R.F. of the scale of Fig. 5 is $\frac{1}{10560}$; calculate the actual distance from the Grammar School to (*a*) St. John's Church, (*b*) Acrefair Station, (*c*) Delph Brickworks. Check your answers by using the scale of the map.

A. 9. On a map of Australia the distance from Melbourne to Adelaide is found to be 8·5 ins. How far are they apart, if the R.F. of the scale of the map is $\frac{1}{30000000}$?

10. Measure the following distances on the maps of Australia and New Zealand in your atlas (i) Cape York to Wilson Promontory, (ii) North-west Cape to Cape Howe, (iii) Melbourne to Sydney, (iv) Auckland to Dunedin, (v) greatest length of North Island, (vi) greatest length of South Island.

A. 11. The distance between two points on a map whose R.F. is $\frac{1}{2500}$ is 6·7 ins. What is the actual distance between them ?

A. 12. The R.F. of the scale of Fig. 6 is $\frac{1}{2500}$. Find by calculation the distance from the Grammar School entrance gate to (*a*) stepping-stones, (*b*) signal-post on railway, (*c*) letter-box on main road, (*d*) centre of bridge of road over the railway. In the cases of (*a*) and (*d*) measure along actual routes. In the cases of (*b*) and (*c*) measure along a straight line. Check your answers by using the scale marked on the map.

A. 13. Find the area in sq. yds. of the plot of land represented by Fig. 7. Supposing the side of one of the small squares in the figure to represent (*a*) one yard, (*b*) three yards, what is the area of a small square in each case ?

A. 14. Find the area of the following rectangles :

(*a*) Length 12 ft. 3 ins., breadth 7 ft. 2 ins.
(*b*) Length 10 ft. 9 ins., breadth 5 ft. 7 ins.
(*c*) Length 282 yds. 2 ft., breadth 136 yds. 1 ft.

A. 15. Examine a sheet of squared paper divided into $\frac{1}{10}$-in. squares. How many $\frac{1}{10}$-in. squares are there in one sq. inch ? What area does one of the small squares represent (*a*) if one inch represents one mile, (*b*) if two inches represent one mile ? Give your answers in sq. yards.

A. 16. What area is included in a $\frac{1}{10}$-in. square on a map drawn to a scale of (*a*) 10 ins. to a mile, (*b*) 6 ins. to a mile, (*c*) 4 miles to 1 in., (*d*) 640 miles to 1 in. ?

A. 17. A certain map is drawn to a scale of 320 miles to 1 in. What is the real area of a country in square miles which on the map was found to contain 380 $\frac{1}{10}$-in. squares ?

A. 18. A sheet of transparent squared paper was placed over a certain area on a map. The number of $\frac{1}{10}$-in. squares included in the

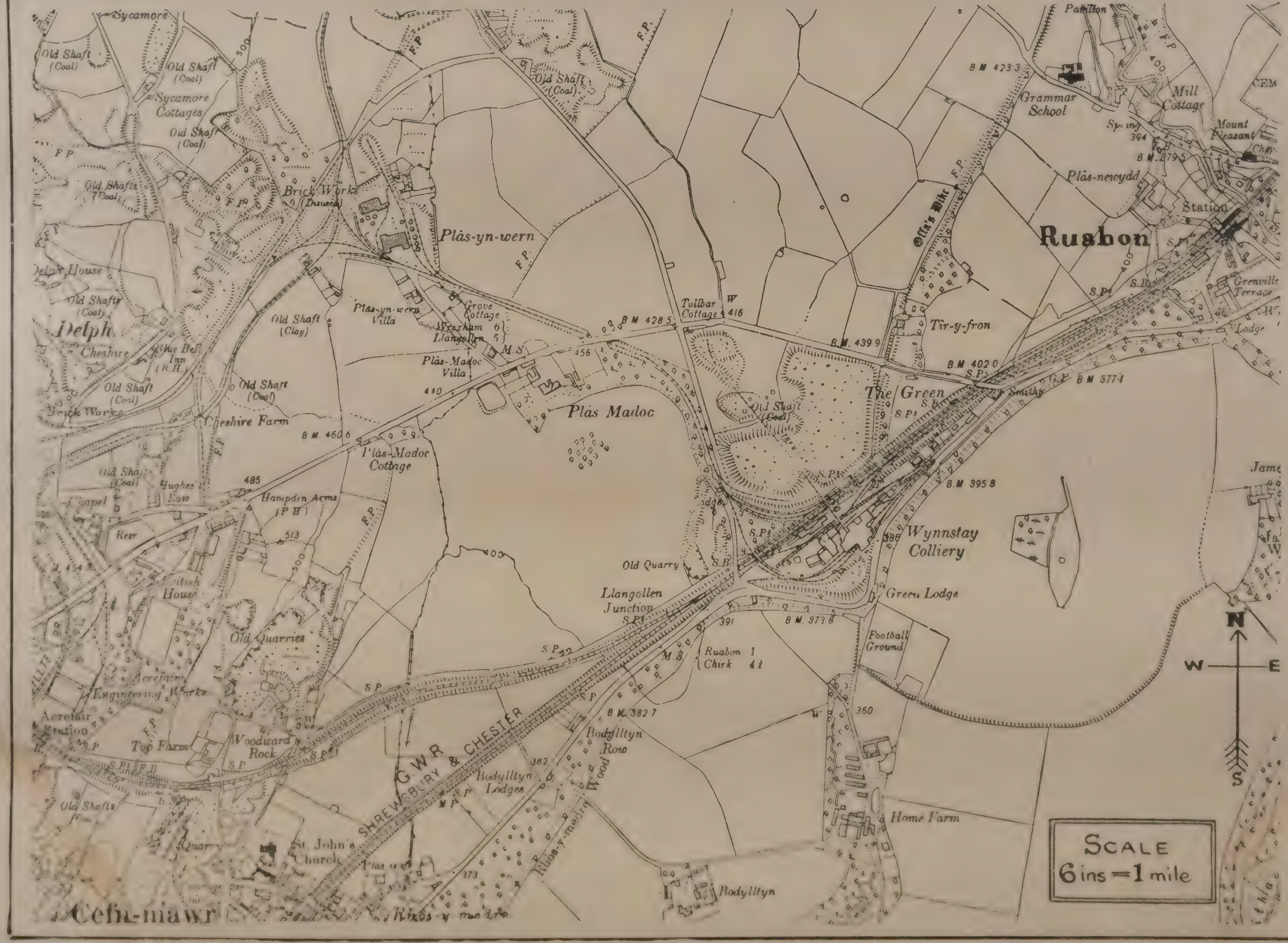

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FIG. 5.

Reproduced from the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office.

FIG. 6.

area was found to be 360. What is the actual area if the scale of the map is 6 ins. to a mile?

A. 19. A certain map is drawn to a scale of

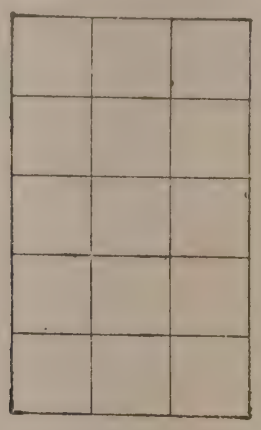


FIG. 7.

$\frac{1}{2500}$. What is the real area of a field in acres which on the map is 2 ins. long and $1\frac{1}{2}$ in. broad? What fraction of an acre does 1 sq. in. represent?

A. 20. Find the area of the land represented in Fig. 5 in square yards and in acres.

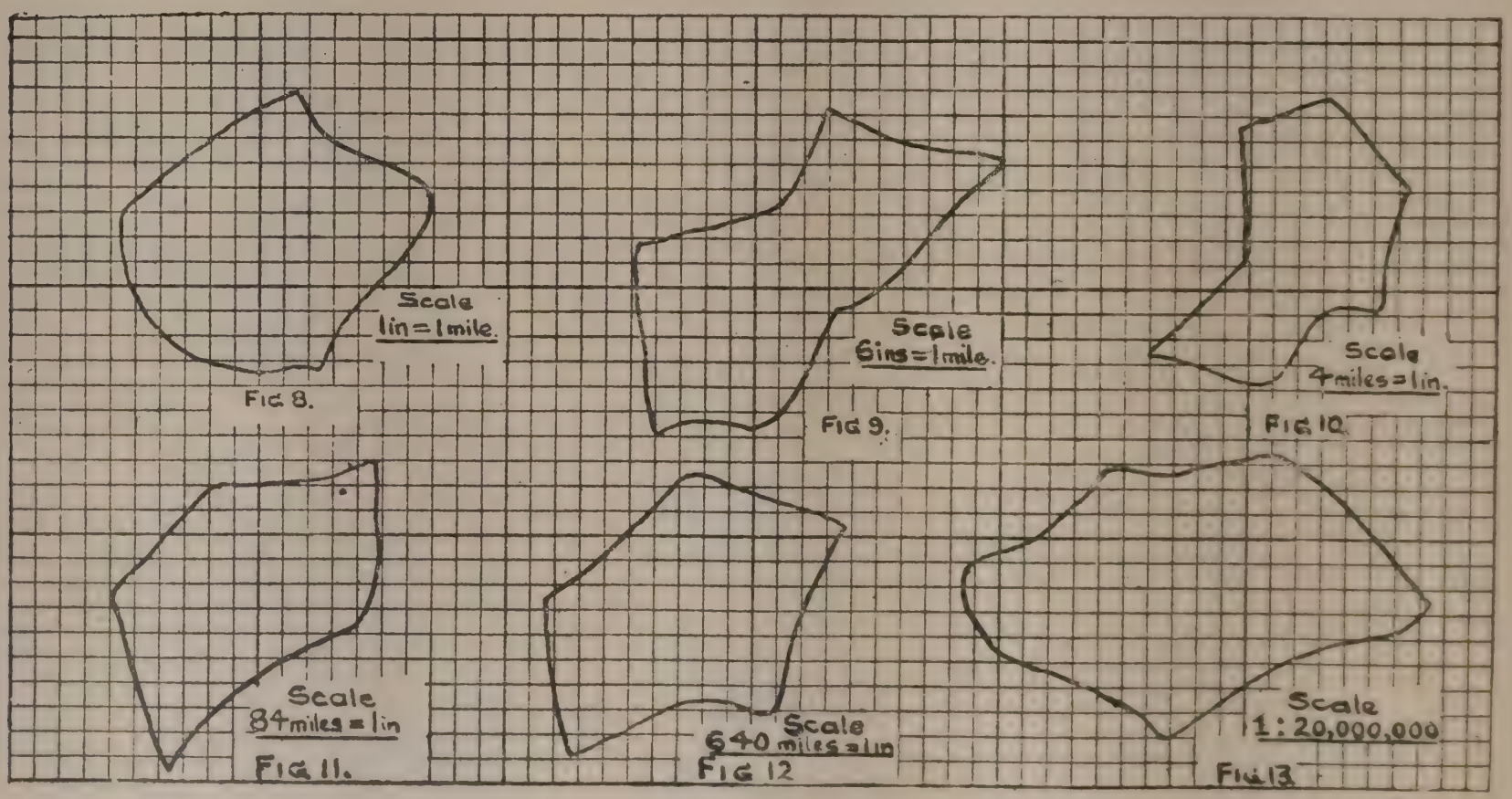
A. 21. Find the area of the land represented in Fig. 6 in acres.

P. 22. Find the area of Figs. 8 to 13, Fig. 9 in acres, the other figures in square miles.

P. 23. From Figs. 14 to 17 find the areas of the playing field (in acres), Denbighshire, Wales, Victoria, and New South Wales (in sq. miles).

24. The area of each of the states of Australia and of New Zealand is shown graphically in Fig. 66. Enter the area of each state in your notebook. What is the total area of Australia? Compare the size of Australia with that of Brazil (3,300,000 sq. miles).

25. Draw, on squared paper, a full-page map of Australia, to show the position of the states and their capitals (see Fig. 67), and write in each state its area as shown on Fig. 66.



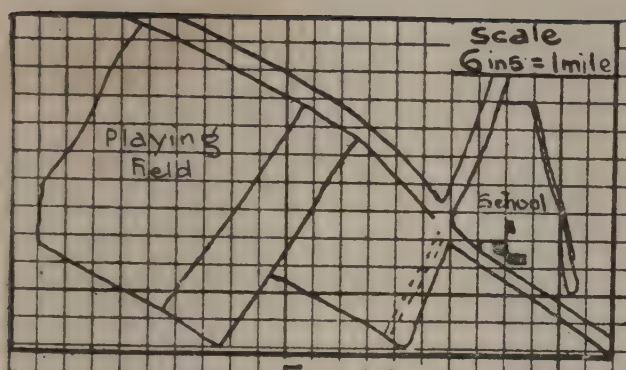


Fig 14.

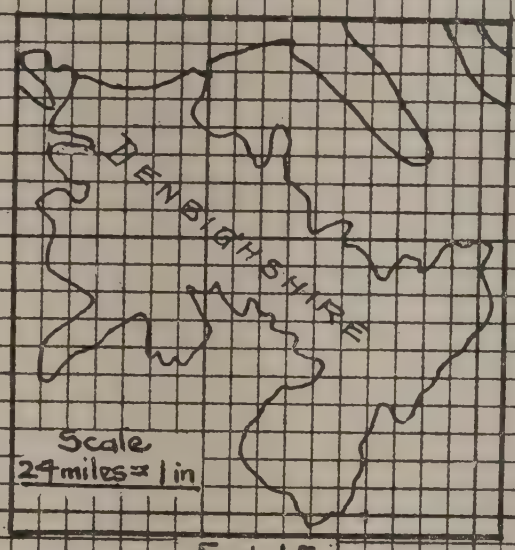


Fig 15.

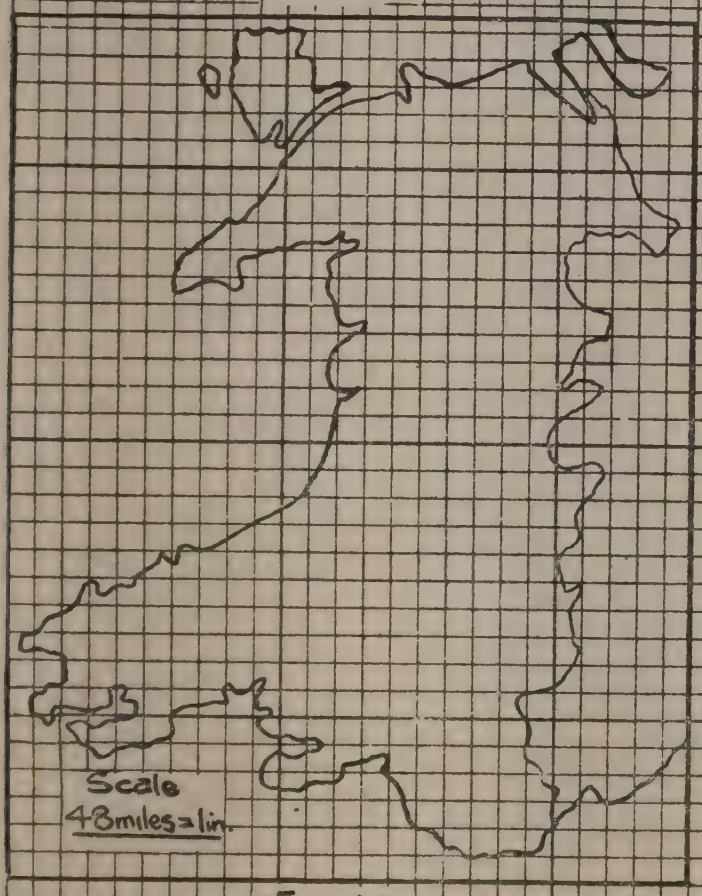


Fig 16.

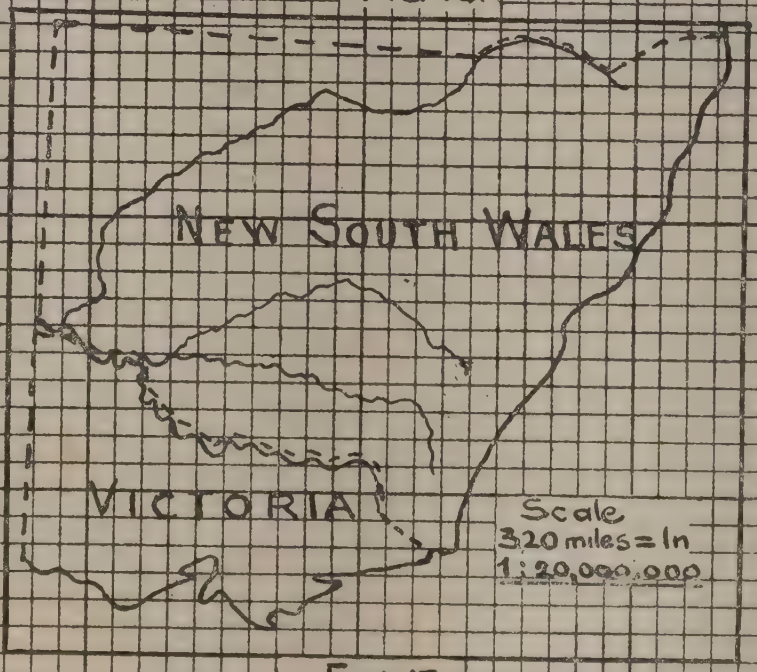


Fig 17

CHAPTER III

ORDNANCE MAPS AND CONTOURS

1. FIG. 20 shows the signs and symbols used on the 25-in. O.S. map. Copy the signs which are used in Fig. 6 into your notebook.

2. Explain the meaning of the numbers which are arranged in pairs in Fig. 6. Verify the areas marked $\frac{843}{2{\cdot}886}$ and $\frac{890}{{\cdot}985}$ by transferring a tracing of each area on to squared paper.

3. Fig. 21 gives further signs and symbols which are used on the 6-in. O.S. map. Which of these symbols do you find on Fig. 5? Make a list of those you identify.

4. Account for the refuse heaps in the centre and west of the area represented in Fig. 5. In what parts of the area are old coal-shafts to be found? What industries are carried on? Account for the mineral lines. Make a list of the place-names found on the map and discover their meaning. Which of the place-names are of historical interest?

5. Find the area of the land represented in Fig. 22 in square miles. What evidences are there on the map to show (*a*) that most of the land to the east of the main railway is farming land, (*b*) that the central part of the map from north to south is a mining and industrial region, (*c*) that the extreme west is lacking in industries? (*d*) Name the collieries and brick-works shown on the map and the centres of population supported by them. (*e*) Give an account of the course followed by Offa's Dyke from the south to the north of the map. (*f*) On which side of Offa's Dyke do you find the greater number of English place-names? (*g*) Make a list of the place-names ending in -ham, -ton, -stock, -bury, and -ley. (*h*) Name the villages which are situated near (1) a park, (2) old coal-shafts, (3) cross-roads, (4) a bridge.

6. Work similar exercises on the O.S. maps of your own district.

***7.** State clearly how to "set a map" in the field by observing the position of objects on the map and on the ground. After setting the map, place a compass with its centre directly over one of the north and south lines which form the margin of the map and (assuming that this line runs directly north and south) find the magnetic declination at this place.

H. 8. Make a model of an island in clay or plasticine, then cut through the model and remove one of the sections (Fig. 18).

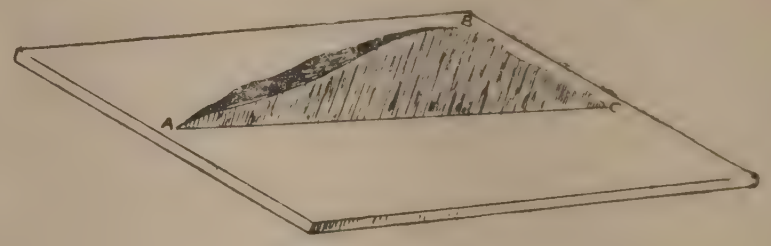


FIG. 18.

Fig. 19 is a diagram which shows the slope of the model along the line through which it was cut. Such a diagram is called a **section.**

FIG. 19.

***9.** Learn how to draw sections, then draw sections to show the rise and fall of the land along a straight line drawn from A to B in Figs. 23 to 28. Use a vertical scale of 1 in. to 1,000 ft.

10. Fig. 29 is a map showing the contours and rivers of Fig. 22. From this map copy into your notebook examples of a water-parting, a steep slope, a gentle slope, a narrow valley, a flat-bottomed valley, a gorge, a knoll, and a spur.

11. Draw sections across the map (*a*) from west to east to pass through Ruabon, (*b*) from Chirk to Bryn, (*c*) from Garth southwards across the Dee and Ceiriog Valleys, (*d*) along the top of the map, (*e*) along the bottom of the map.

12. Write an account of the relief of the area represented in Figs. 22 and 29.

13. Place a sheet of transparent paper over Fig. 22 and trace carefully in red ink the first-class roads.

14. Place your tracing over Fig. 29 and answer the following questions: (*a*) Why does the main road from the Ceiriog Valley to the Dee Valley go round through Chirk? (*b*) What is the distance from the Ceiriog to the Dee along the margin of the map? What is the distance along the main road? (*c*) Account for the curious

Every parcel is numbered thus.....27

Its area is given underneath in Acres, thus.....4·370

Braces, indicating that the spaces so connected are included in the same reference number and area.....

The Altitudes are above the assumed mean level of the Sea at Liverpool.

Altitudes with the letters B.M marked ↑ against them, refer to marks made on Buildings, Walls, Milestones &c., (Bench Marks).

Surface Levels along roads, and of Trig! Stations, obtained by Spirit levelling, are written thus 326·, the cross shewing the spot at which the altitude is taken

W.D. Boundary Stone..... B.S. W↑D

Adm.y Dep.t —,,— ..... —,,— A⚓D

Boundary Stone.....*B.S*

—,,— *Post*.....*B.P*

Foot Path.....*F.P.*

Bridle Road.....*B.R.*

Trig! Station.....△

Altitude at Trig! Station....507 △

Bench Mark.....*B M 325·9* ↑

Surface Level.....342 ·

Mile Stone.....*M.S*
Pump.....*P*
Signal Post.....*S.P*
Guide Post.....*G.P*
Letter Box.....*L.B*
Sun Dial.....*S.D*

Spring.....*Sp.*
Well.....*W*
Mooring Ring.....*M.R*

Trough.....*Tr.*

Antiquities (Site of)

Arrow denotes flow of water

Marsh

Orchard

Fir

Mixed Wood

Wood, Deciduous

Bush

Brushwood

Railway crossing Road

Cutting

Osiers

Embankment

Furze

Flat Rock

Road crossing Railway

Railway crossing River or Canal

Rough Pasture

Level Crossing

Waterfall

Open Country

Ford

Road over River or Canal

Quarry

Sand Pit

27
4·220

28
·190

30
·270

29
3·670

F.P.

Lock

Sloping Masonry

Stepping stones

Road over single stream

B.R.

Shingle

Refuse Heap

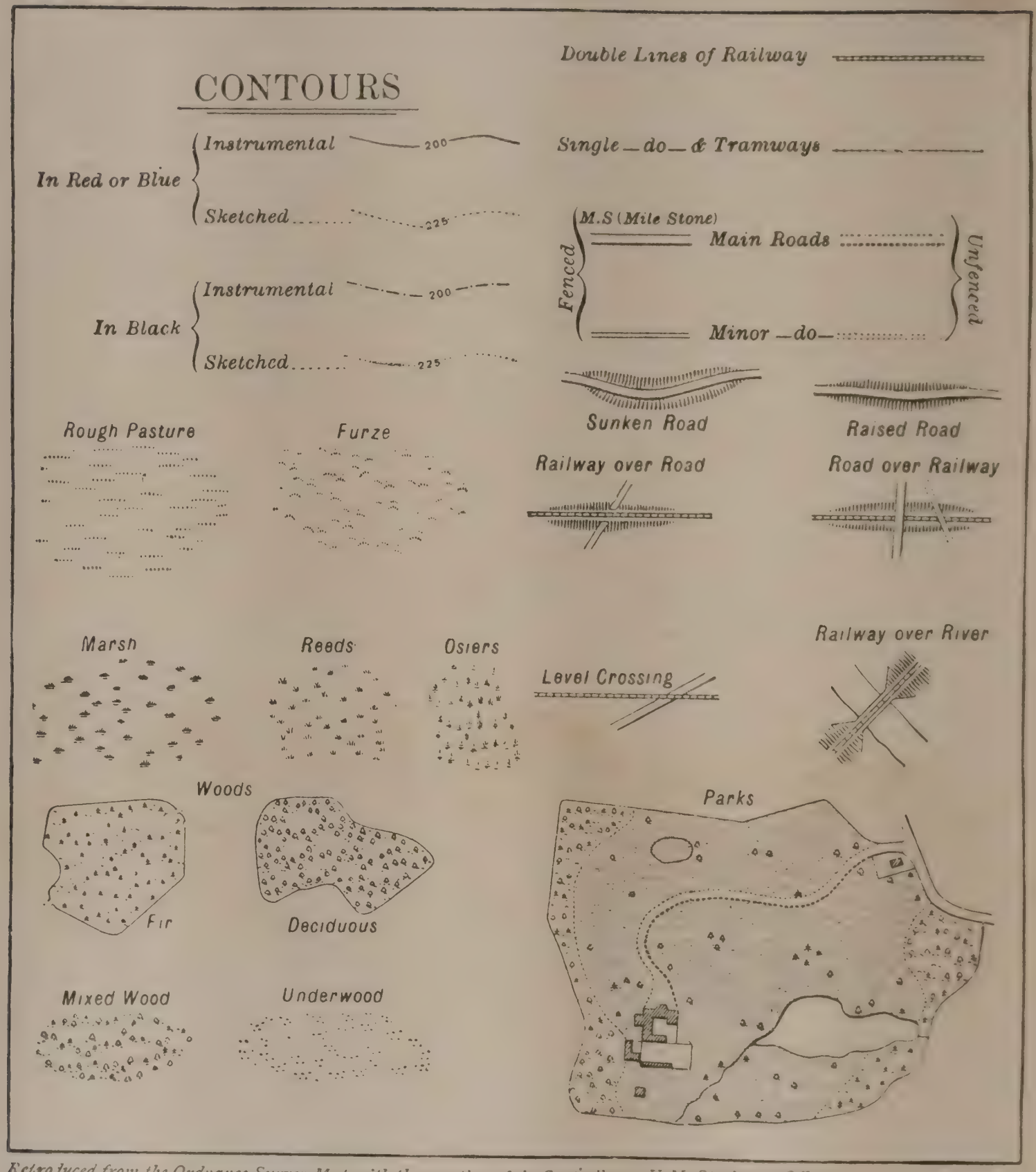
Gravel Pit

Clay Pit

Ferry

Reproduced from the Ordnance Survey Map with the sanction of the controller of H.M. Stationery Office.

FIG. 20.



Reproduced from the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office.

FIG. 21.

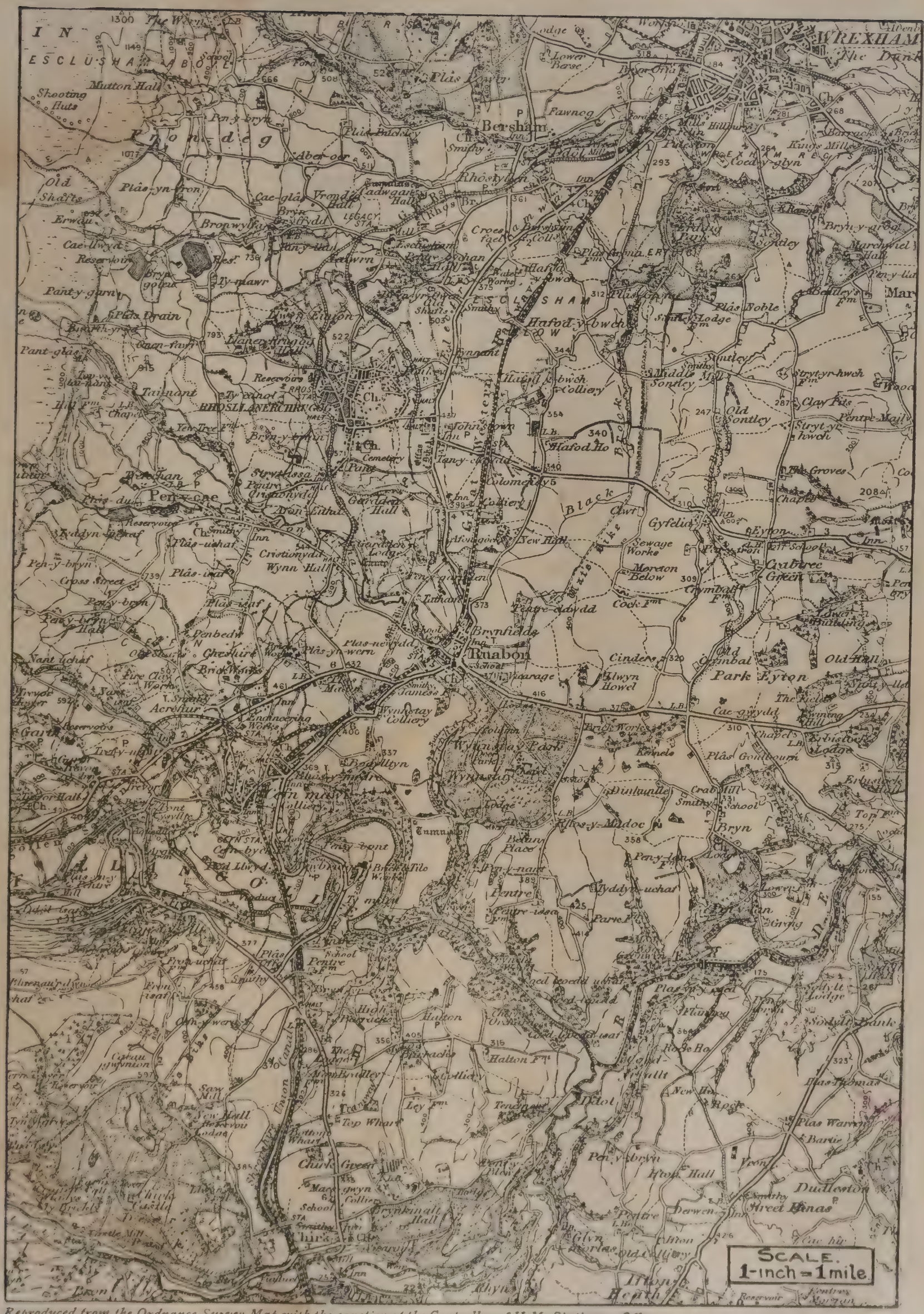

WREXHAM
Bersham
Ruabon
Hafod-y-bwch Colliery
Brymbo
Park Eyton
Pentre
Plas Power
Plas Noble
Plas Grono
Plas Gronw
Plas Drain
Plas Coch
Plas Madoc
Plas Goulbourn
Plas Warren
Plas Thomas
Plas Isaf
Plas Acton
Plas Ucha
Plas Yn Yale
Plas Yn Cefn
Plas Yn Eglwys
Plas Yn Llan
Plas Yn Rhos
Plas Yn Dre
Plas Yn Ty Mawr
Plas Yn Ty Mynydd
Plas Yn Ty Nant
Plas Yn Ty Ucha
Plas Yn Ty Isaf
Plas Yn Ty Gwyn
Plas Yn Ty Coch
Plas Yn Ty Du
Plas Yn Ty Llwyd

FIG. 23.

FIG. 24.

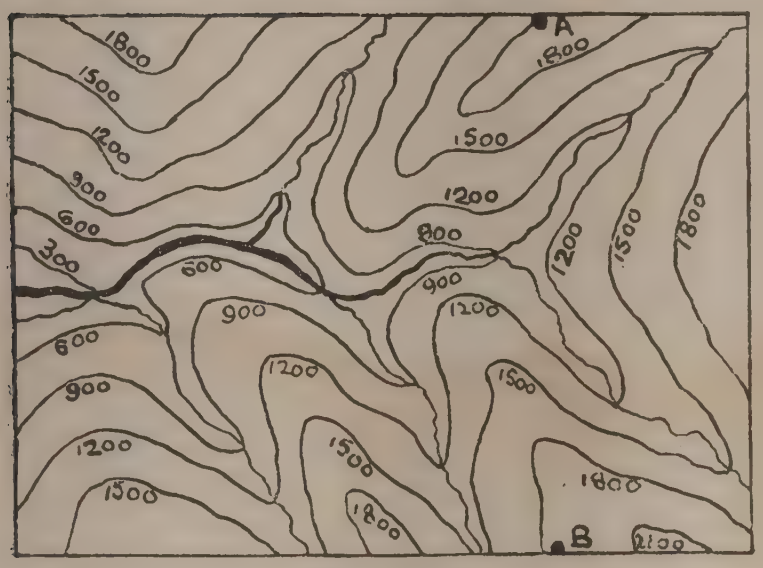


FIG. 25.

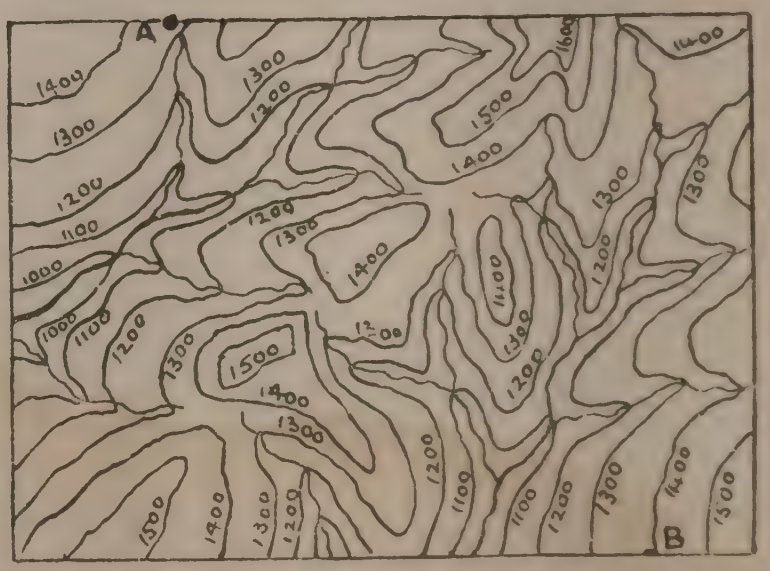


FIG. 26.

FIG. 27.

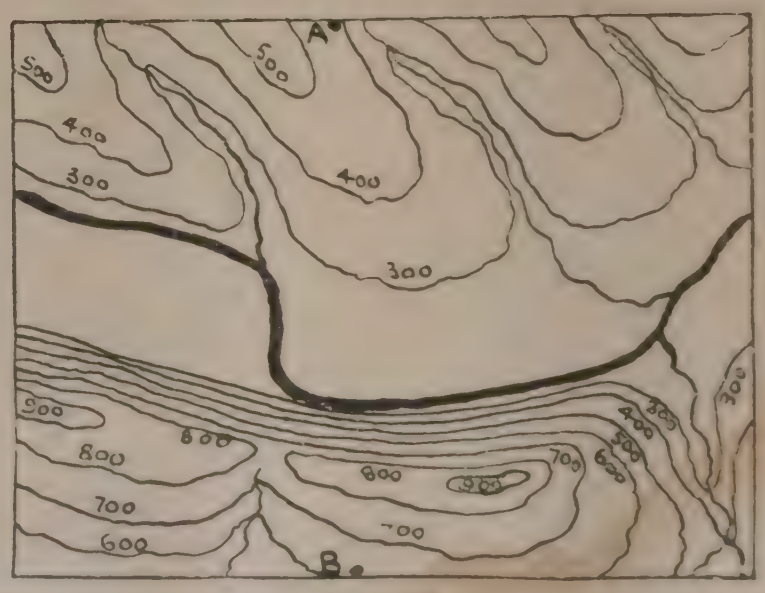


FIG. 28.

Scale: 1 in. = 1 mile

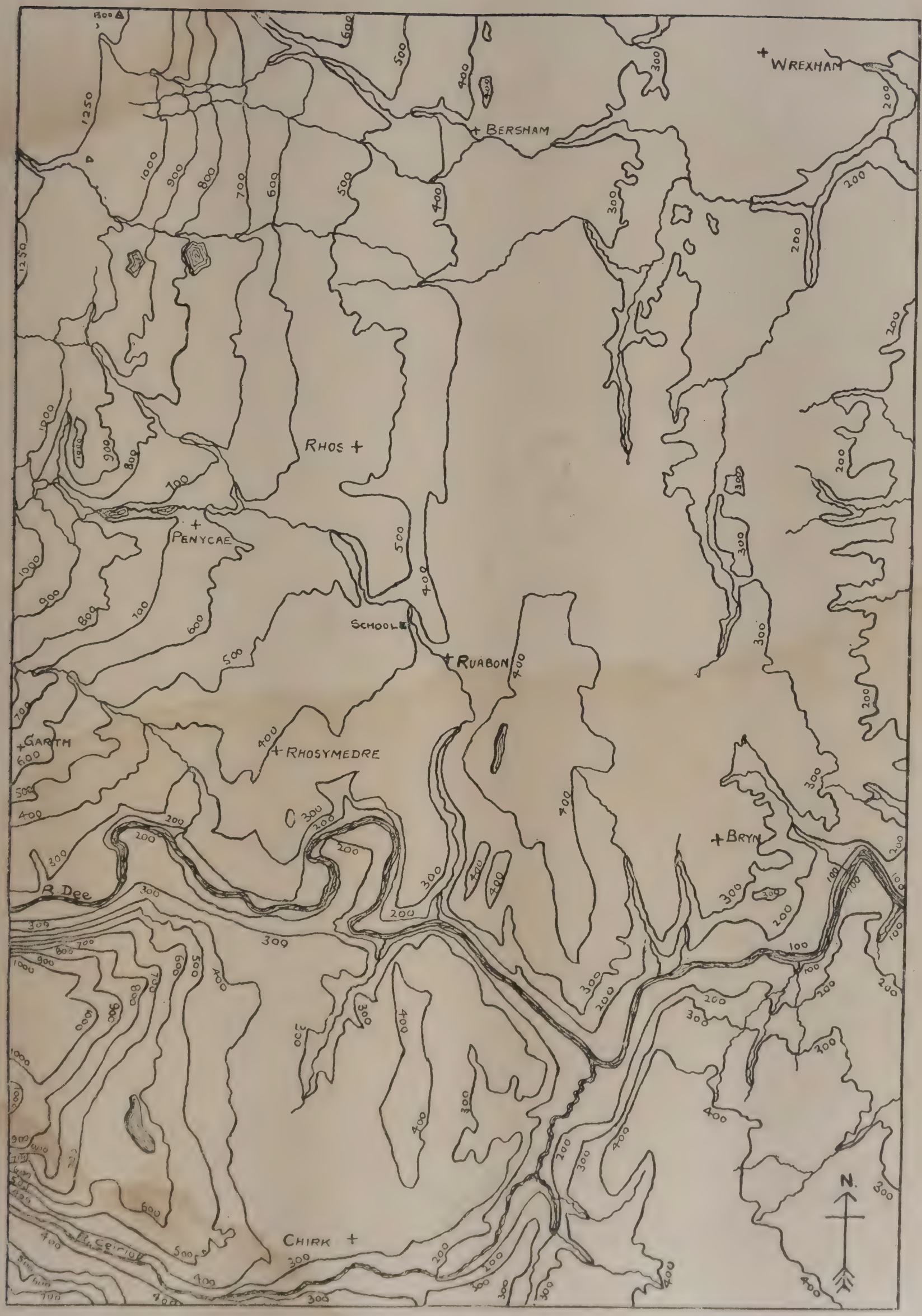

WREXHAM
BERSHAM
RHOS
PENYCAE
SCHOOL
RUABON
GARTH
RHOSYMEDRE
BRYN
R. Dee
CHIRK
N.

FIG. 29.

bend in the road to the south of Cefn Mawr. (*d*) Give examples which support the statement that roads in hilly regions follow the contours and river-valleys as far as possible.

15. Place your tracing (question 13) again over Fig. 22 and trace the railways in blue ink.

16. Place the tracing over Fig. 29. Which section of the Great Western main line from Wrexham southwards presented great engineering difficulties? How were they overcome? How many bridges are there (i) over, (ii) under the railway between Wrexham and Chirk station? At which point on the main line would you obtain the finest view? Describe this view. There is a narrow-gauge railway running from Chirk station up the Ceiriog Valley; why does it lie on the main road?

17. Examine Fig. 22 again, and account for the large number of second- and third-class roads (i) to the east of the railway, (ii) to the west of the railway. Why do the roads which run westwards end at or near the 1,000 ft. contour line?

CHAPTER IV

RIVERS, WEATHERING, ROCKS, AND HUMAN ACTIVITIES

1. THE changes brought about by running water are of such far-reaching human importance in all countries that the study of the local brook should be undertaken as soon as possible. Before turning your attention to the brook, you should visit a country road during or immediately after a heavy rainstorm. There you will find, on a small scale, many of the features of the rivers of the world. You will see minor changes taking place which, in many lands, are brought about very slowly and on a large scale.

Take advantage of the opportunity offered by the next rainstorm to examine a roadside ditch and the tiny runnels which form on the road for evidence of the following important facts relating to a river: (*a*) a river flows down the steepest slope; (*b*) a river cuts a groove (called a **valley**) in the land; (*c*) a river runs at the bottom of the valley (called the **bed** or **channel**); (*d*) a river wears away the surface of the land; (*e*) a river carries away gravel and sand; (*f*) an obstruction may cause a **waterfall**, or it may cause the river to flow round the obstruction; (*g*) a sudden change in the slope will cause a river to drop part of its load of sand and gravel (rock waste dropped by a river is called **alluvium**); (*h*) hollows are filled with water forming **lakes**; (*i*) where a river enters a lake its rate of flow is checked and alluvium is deposited, forming a **delta** at the head of the lake; (*j*) in time a lake becomes filled with alluvium and a **lake plain** is formed; (*k*) a river is joined on either side by other rivers (called **tributaries**), each of which flows in a valley originally proportioned to the size of the stream (the place where two rivers join is called a **confluence**); (*l*) at a greater or less distance from the **source** of a river the land begins to slope away towards some other river; (*m*) a line may be drawn separating the water which flows into one river from that which flows into other rivers (this irregular line is called a **divide** or **water-parting**, and the land which is drained by a river and its tributaries is called a **river basin**).

2. Draw a map of South America. Show (*a*) the basins of the Amazon, Orinoco, and Parana-Paraguay Rivers; (*b*) the divides separating the basins; (*c*) a town at a confluence; (*d*) in the case of each river name one of its tributaries.

The next four experiments will help you to understand some of the results of river action.

P. 3. Weigh a stone first in air and then in water. What does the result show?

C. 4. Why is it necessary to use distilled water in the chemical laboratory? Find whether the local brook carries any matter in solution or not.

C. 5. Fill two beakers with water from the local brook, one when the brook is normal, the other when the brook is in flood. Compare the amounts of sediment deposited in the beakers.

6. Place some fine soil, sand, gravel, and pebbles in a large glass jar half filled with water. Stir until everything is in motion. Stir more slowly. What happens? Stop stirring altogether and observe the order in which the materials settle.

7. By observation of the local brook and by experiment at different parts of its course, prove the truth of as many as possible of the following statements:

(*a*) A river flows faster (i) when in flood than when normal, (ii) where the slope of the channel is steep than where it is gentle, (iii) near the concave bank than near the convex bank where the river bends.

(*b*) A river (i) wears away the land, (ii) carries along rock fragments, and (iii) builds new land by depositing rock material.

(*c*) The destructive power of a river and its power to move along heavy rock fragments are greatest (i) where the slope of the channel is steepest, and (ii) when the river is in flood, that is, the power of a river (in any given part of its course) increases with an increase in the rate of flow.

(*d*) Where there is a marked decrease in the velocity of the river, material is deposited. This occurs (i) at a convex bank where the river bends, forming a strip of **flood plain**; (ii) where a fast-flowing tributary joins a main stream in a flat valley, forming an **alluvial fan**; (iii) where a river enters a lake or calm sea, forming a **delta.**

(*e*) In the **upper course** (with certain exceptions to be noticed later) (i) the river occupies the whole of the floor of the valley; (ii) the river transports rock material and cuts downwards, forming a steep-sided valley—the cutting tools are the stones and boulders, which are reduced in size and rounded in the process; (iii) **waterfalls** and **rapids** exist where the bed of the river consists of hard rock. Waterfalls move upstream, forming **gorges** below the falls.

(*f*) In the **middle course** (i) the river develops a winding course; (ii) the river is engaged in widening its valley, and in doing so both destroys and builds. It destroys by undercutting the concave banks, and builds new land near the convex banks by depositing material which it has carried down stream; (iii) alternating high banks and alluvial strips of flood plain are characteristic features.

(*g*) In the **lower course** (i) the original banks have been entirely consumed, giving place to an open flood plain through which the river winds in serpentine curves called **meanders**; (ii) when meanders become much exaggerated, the river may cut through the narrow necks of the loops, leaving a portion of its old channel as an "**ox-bow**" lake, which in time becomes silted up; (iii) the gradient is often so small and the load of silt is so great that the river has barely enough power to transport its load to the sea—some of the silt is then dropped in its own bed, building it up until the river stands above the level of the plain. Artificial **embankments** are necessary to keep the river in its channel.

8. Draw enlarged copies of Figs. 30 to 39 in your notebook and write explanatory notes under each. (Fig. 39 shows deltas forming where rivers enter a lake.)

9. Collect views to illustrate the points referred to in the foregoing questions, and arrange them in an album.

10. You have learned that in its upper course a river is actively engaged in excavating its valley, so that if the river acted alone, the valley would be no wider at the top than at the bottom and would resemble a deep trench in cross section (Fig. 40). Evidently there must be other forces at work driving the valley sides apart to produce the familiar V-shaped valley (Fig. 41). The rate at which the valley sides recede depends partly on the character and arrangement of the rocks. You will find that some rocks wear away very easily. Collect specimens of limestone, sandstone, shale, coal, slate, chalk, conglomerate, and granite. Which of these rocks are found in the school district? On a sketch-map of the school district show where some of the above named rocks may be found.

11. Put some mud from the bed of a pond or brook in a box. Cover it with a board which tightly fits the inside of the box. Put heavy weights on the board, and when the mud has dried compare it with your rock specimens. Which does it resemble most?

12. Put sand in an old jar. Cover it with lime-water. In a similar jar put sand and cover with tap-water. When the water in each jar has dried up, break the jars and compare the contents.

13. Weigh a piece of dry sandstone, then soak it in water for a day. Weigh again. What has happened?

14. Examine each of your rock specimens and describe the characteristics of each under the following headings: (1) Structure; (2) Hardness; (3) Porosity.

P. 15. Explain why water-pipes often burst during frost. Suppose the stone referred to in question 13 was subjected to many wettings and freezings, what would ultimately happen?

P. 16. Place a thin piece of stone in a fire. What happens? Heat another small piece slowly, then cool it quickly by placing it in cold water. What happens? Why does a tumbler sometimes crack when hot water is poured into it?

C. 17. Explain why it is necessary to paint iron fences and iron buildings.

C. 18. Place a lump of salt in water. What happens? Describe an experiment to show that limestone is attacked by rain-water.

19. Whenever opportunity occurs, visit a quarry or a cliff. Examine the rocks. If they are arranged in layers, are the layers horizontal or tilted? Do questions 6, 11, and 12 suggest how these rocks may have been formed? Be on the look-out for cracks in the rocks. If there are trees growing on the cliff, look for illustrations of roots levering rocks apart. Examine the fragments of rock lying at the foot of the cliff. Are they of the same kind of rock as the cliff? Compare these fragments with pebbles taken from the brook: account for the difference in shape. Did you find any rock fragments in the upper course of the local brook which had recently fallen from the valley sides? The rock waste at the foot of the cliff and the boulders which have fallen into the river bed are due to the combined work of the **agents** considered in the foregoing exercises, viz. air, rain, freezing water, sudden changes of temperature, and plants. The work which they perform in nature is called **weathering.** Wind is also a sculpturing agent, but it is only in dry regions, where the ground

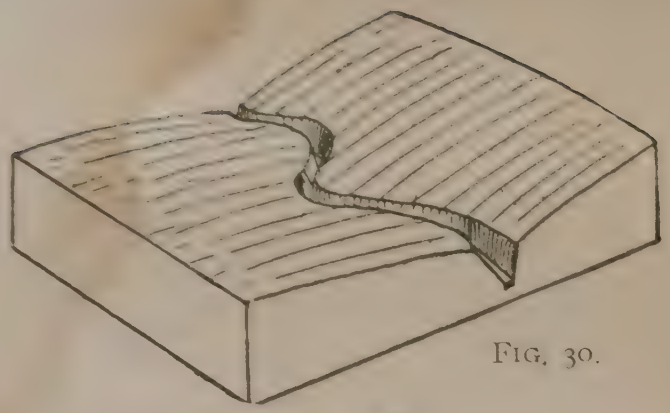


FIG. 30.

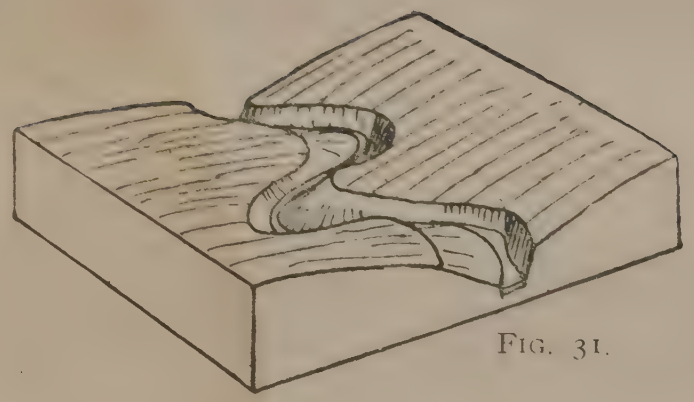


FIG. 31.

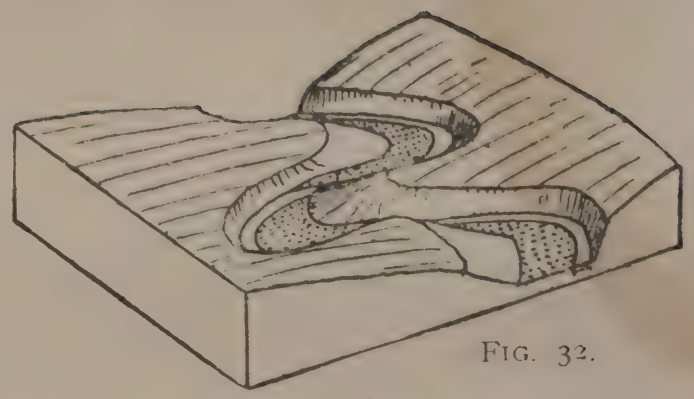


FIG. 32.

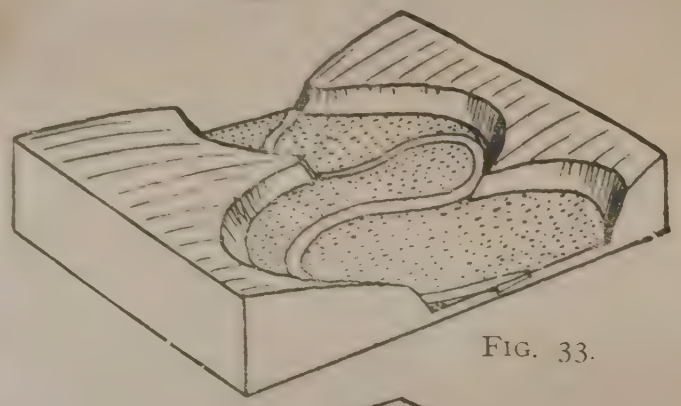


FIG. 33.

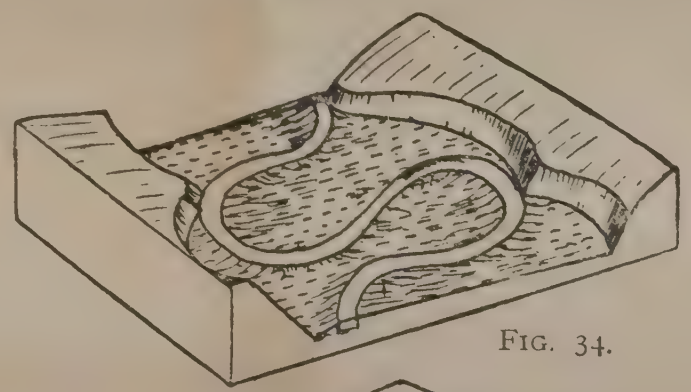


FIG. 34.

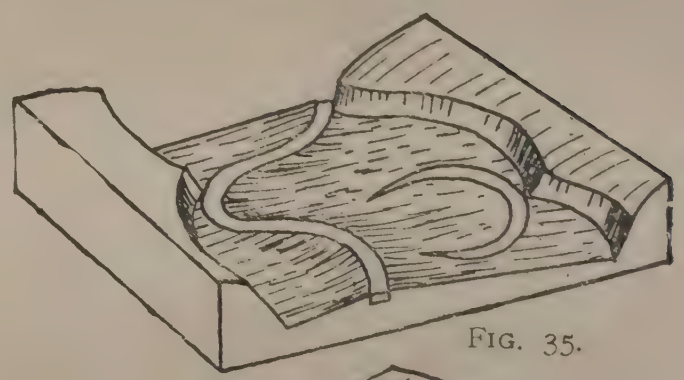


FIG. 35.

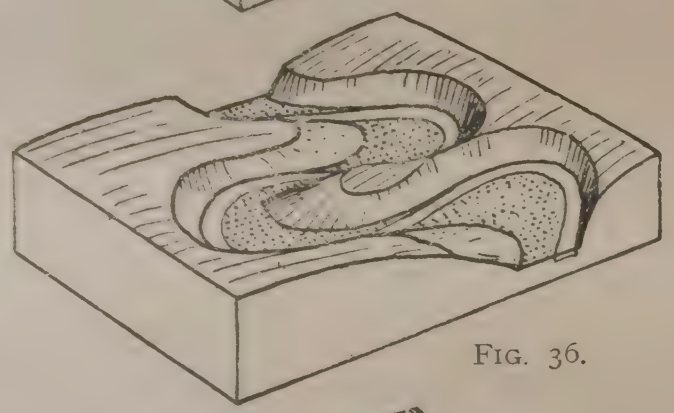


FIG. 36.

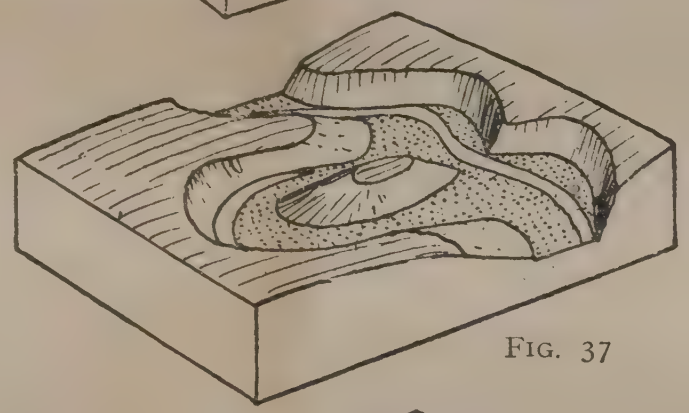


FIG. 37

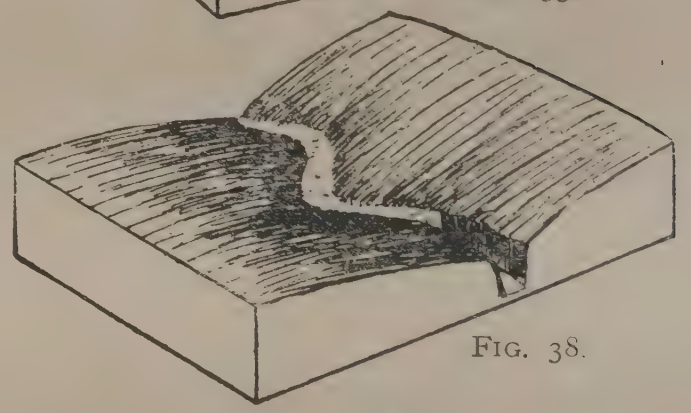


FIG. 38.

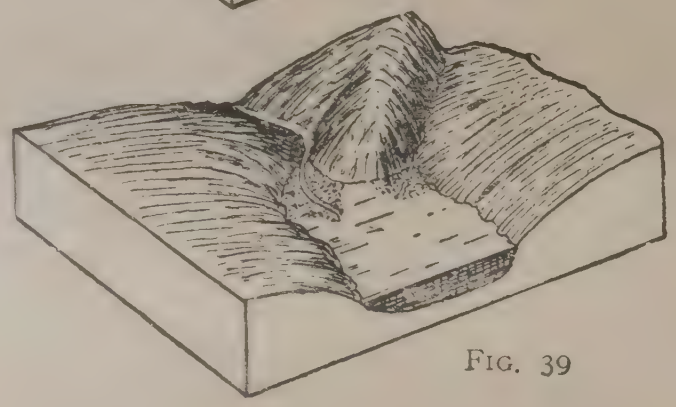


FIG. 39

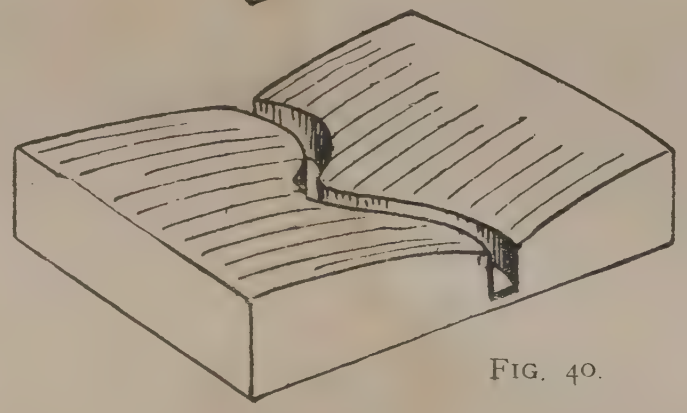


FIG. 40.

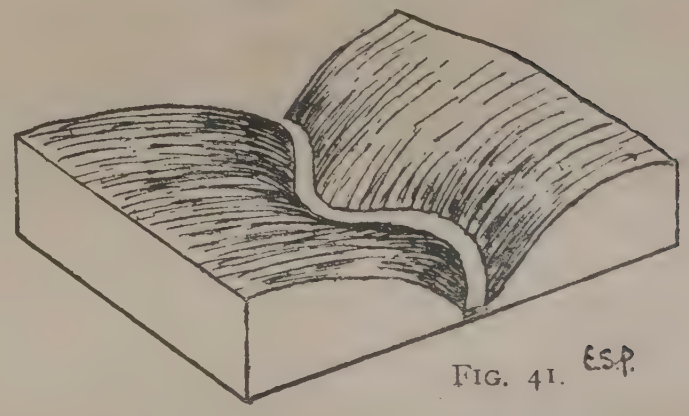


FIG. 41. E.S.P.

is bare, that the work of wind is important. The most important result of weathering is the formation of soil.

*20. Write a short account of the way in which each of the weathering agents does its work.

21. Write sentences to illustrate the meaning of the following words: porous, soluble, permeable, sedimentary, stratified, denudation, erosion, joint planes.

22. If the physical facts touched upon in this chapter have awakened your interest in your home district, you will be still more interested when you come to examine them in relation to the life of the district. You will discover that man's life is deeply affected by his physical surroundings. You will notice how physical features direct and modify the course of human action, and how they largely determine the number of people the land supports.

Numerous illustrations of the influence of natural features upon the activities of man are to be found in the area represented in Fig. 20. Examine the map for examples to illustrate the following geographical facts:

(1) River valleys provide routes for roads and railways. (2) In hilly regions the valley which affords the best route is the most important. (3) Where valleys are narrow, routes cling to the valley sides, either because there is no room on the valley floor or because of the presence of marshes and floods. (4) The upper course of a river is unnavigable, but the steep gradient affords water-power for mills. (5) The broad plains of the lower course and the stretches of flood plain of the middle course form rich agricultural and pastoral lands and encourage farming. (6) The valley sides, where not too steep, provide pasture for animals and occasional plots for cultivation; but highland valleys are not suited for extensive cultivation. (7) The steeper slopes of valleys are often well wooded. (8) A valley route encourages quarrying in the valley sides if there is a demand for the rock products. (9) Population in hilly and in highland regions tends to collect in the broader valleys. (10) The upper courses of rivers are often dammed to form reservoirs this ensures a constant supply of unpolluted water to populous centres.

Rocks. (1) The occurrence of granite, slate, sandstone, or limestone gives rise to quarrying (*a*) if there is a demand for the product in the neighbourhood, (*b*) if the means of transport is cheap, or (*c*) if the product is of exceptional quality. (2) Coal mining gives employment to a large number of people. (3) Where coal, limestone, and iron ore are found in close proximity, iron-works arise. (4) The presence of good-quality clay in populous districts encourages the making of bricks, tiles, and drain-pipes. (5) Industrial districts are thickly populated and are abundantly supplied with roads and railways.

23. Study the everyday life of your own district. Notice how the river features and the distribution and character of the rocks have helped to determine the occupations of the inhabitants, the nature of the trade, the density and distribution of population, the position of towns and villages, the means of communications, the direction of routes, and the history of the district.

Examine the $\frac{1}{2}$-in., 1-in., and 6-in. O.S. maps of your own district and learn how these human facts are represented on a map.

CHAPTER V

RELIEF, CLIMATE, AND DRAINAGE

1. EXAMINE the orographical maps of Australia and adjacent islands in your atlas. Notice, in Australia, (*a*) the highlands extending along the east coast; (*b*) the plateau, which occupies the western half of the continent; (*c*) the low, narrow, west-to-east divide running from the plateau to the Eastern Highlands; (*d*) the isolated highland mass to the east of Spencer Gulf; (*e*) the range of highlands to the north of New Guinea. Notice (*f*) that New Zealand consists of two large islands and one small island; (*g*) that both large islands are mountainous; (*h*) that the highlands of South Island are near the west coast; (*i*) that the south-west of South Island resembles the south-west of Chile; (*j*) that the lowlands of New Zealand are not extensive.

2. Draw a full-page map of Australia (see Fig. 45) and shade in pencil or water-colours the relief features referred to in question 1. Mark in ink the names given to (*a*) the Eastern Highlands as a whole; (*b*) the highest part of the Eastern Highlands; (*c*) the highlands to the west of Sydney; (*d*) the highlands to the west of Brisbane; (*e*) the highlands in the north-east of New South Wales; (*f*) the highlands in the east of Victoria; (*g*) the south-western edge of the western plateau; (*h*) the highlands to the east of Spencer Gulf and Lake Torrens; (*i*) the region situated between the Murray and Murrumbidgee Rivers.

3. Draw a full-page map of New Zealand, show the relief features as directed in question 2, and mark in ink the names given to (*a*) the three islands; (*b*) the straits separating the several islands; (*c*) the mountains of South Island; (*d*) the eastern plains of South Island; (*e*) the volcanic cone in the south-west of North Island; (*f*) the lake in the centre of North Island; (*g*) the highest peak in New Zealand.

***4.** Refer to books in the school library for first-hand descriptions of different parts of Australia and New Zealand. Write short summaries of the passages which describe the physical features.

5. Enter the following in your notebook, inserting and underlining the omitted words:

Australia is a compact mass of land with very few large openings. The largest opening is the Gulf of in the north. There are three important inlets in the south-east, namely, Gulf, Gulf, and Port Bay. New Zealand has many inlets, the largest of which are Gulf, Bay of , and Bay in North Island, and Bay in the north of South Island. The south-west coast of South Island is similar in character to the south-west coast of in South America.

The relief of Australia falls into three divisions: (*a*) The Eastern Highlands. (*b*) The Western Plateau. (*c*) The Central Lowlands.

The Eastern Highlands extend from Cape in the north of Queensland to the extreme south of Tasmania. They rise steeply from the coastal plain, but the slope towards the west is not so steep. The Eastern Highlands are sometimes called the Range, but the general appearance of the Highlands is that of a narrow plateau, deeply trenched in places by rivers. The highest parts are in the south-east, where they are called the Alps. West of Brisbane the highlands are called the Downs, while to the west of Sydney are the deeply trenched Mountains. The highlands in the north-east of New South Wales are called the Plains. A branch of the highlands passes westwards through Victoria. Tasmania is an isolated portion of the Eastern Highlands, from the main mass of which it is separated by Strait. The Western Plateau occupies the western half of Australia. From the sea the broken edges of the plateau have the appearance of steep mountain ranges. The south-western edge is called the Range. Flat-topped hills and pillars and vast stretches of sand interspersed with tussocks of strong spiny grass, called spinifex, are common features of the plateau.

The Central Lowlands extend across the continent from north to south between the Eastern Highlands and the Western Plateau. They are divided by higher land into three parts: (i) the north-coast lowlands around the Gulf of , (ii) the inland drainage areas of Lakes and , (iii) the basin of the and its tributaries. That region which lies broadly between the Murray and Murrumbidgee is called the .

An interesting feature of Australia is the

Great Reef, which extends along the coast of for a distance of 1,200 miles. The Reef is separated from the coast by a channel which varies from ten to thirty miles in width.

New Zealand is a mountainous country. The Alps, which extend along the west coast of South Island, resemble the Andes of South America. The highest peak, Mount , is over ft. high. To the west and south-west of Banks Peninsula are the Plains. Numerous picturesque lakes lie in the foothills to the east of the western ranges. Similar lakes are also found in the foothills of the Andes in Patagonia. The mountains of South Island are continued in the ranges which run parallel to the east coast of North Island. The district around Lake in North Island is famous for its volcanoes and geysers. Mount in the west of North Island is an extinct volcano.

The large island of New Guinea consists of a mountainous region in the north and east and a lowland region in the south. Mountain ranges over 13,000 ft. high run across the island from south-east to north-west.

6. Draw sections across the map of Australia (i) from Geraldton to Brisbane, (ii) from Port Augusta to Sydney.

A. 7. Make a tracing of the outline and 1,000-ft. contour of Tasmania (Fig. 42). Transfer the tracing to squared paper and calculate what percentage of Tasmania is over 1,000 ft. high. Estimate the amount of land exceeding 3,000 ft. high.

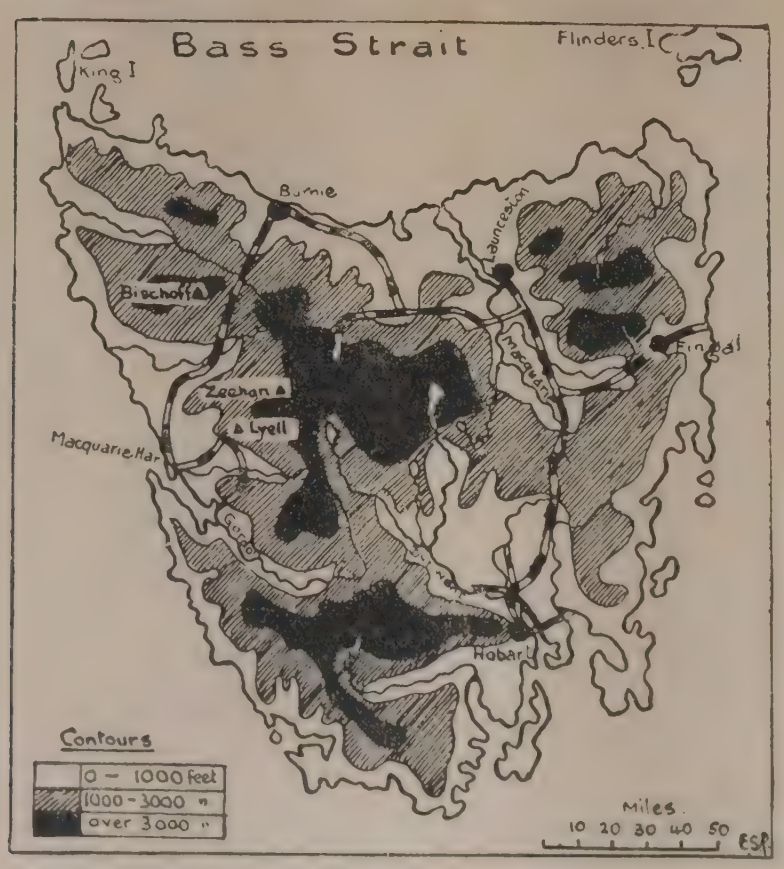


FIG. 42

CLIMATE

8. In Book I you discovered that the distribution of temperature is controlled by the following factors: (*a*) Latitude, (*b*) Altitude, (*c*) Relation to the sea, (*d*) Prevailing winds, (*e*) Ocean currents. Take each factor in turn and briefly explain how it affects temperature.

9. The relation of the interior of a continent to the sea and prevailing winds is determined by the shape and relief of the continent. Examine Figs. 43 and 44 and the orographical map (Fig. 45), and point out how the unbroken outline of the continent, the position of its highlands, and its great extent in the trade-wind and horse-latitudes belts cause the influence of the sea to be confined almost wholly to the coastal margins.

10. Figs. 45 and 46 show the sea-level isotherms for January and July. Notice that, as in South America (Figs. 68 and 69), the temperature within the Tropics is always high. Complete the following statement in your notebook:

The mean monthly sea-level temperature of Australia, north of the Tropic of Capricorn, excepting a small area near the Tropic, is always over °F. In the hottest month the temperature is well over °F. throughout the whole of this region.

11. From the temperature maps estimate the January and July sea-level temperatures of the following towns: Brisbane, Sydney, Melbourne, Hobart, Wellington, all of which are on the east coast and at sea-level. How do you account for the difference in their temperatures?

12. The following table gives the January and July temperatures of places which are approximately in the same latitude. Find these places on Figs. 45 and 46 and in your atlas and copy the table into your notebook, fill in the range of temperature and account for the differences in the range in each group

	Latitude.	January temperature.	July temperature.	Range.
	degs.	degs. F.	degs. F.	
I. Geraldton	28	74	59	
Strangeway Springs	29	84	56	
II. Port Macquarie	31	73	54	
Bourke	30	84	51	

FIG. 43.

FIG. 44.

13. Place a tracing of the January isotherm map over the July isotherm map. Shade the regions which have a range of over 30° F. Explain why the range of temperature is greatest in the regions shaded.

14. Estimate the average range of temperature in Tasmania, New Zealand, and New Guinea. Account for the small range of temperature in Tasmania and New Zealand. Does the same explanation serve to account for the extreme smallness of the range in New Guinea ?

Regions in which the range of temperature is great are said to have an **extreme** or **continental** climate. Regions in which the range is small are said to have an **equable** or **maritime** climate.

15. The following table, giving the January temperatures of places which lie near each other, will serve to show that temperature is affected by altitude. Calculate the rate at which the **January temperature** is reduced by elevation :

	Altitude.	January temperature.
	feet.	degs. F.
I. Brisbane . .	141	77
Toowomba . .	2,051	70
II. Sydney . .	148	71
Kiandra . .	4 642	56

16. Study the temperature maps and relief map; then explain why the highlands of the south-east of Australia are covered with snow for several months in the year.

17. Copy the following table into your note-book and with the help of the temperature maps fill in the vacant columns :

MEAN TEMPERATURE IN LAT. 30° S.

Month.	South America.			Australia.		
	West Coast.	East Coast.	Range.	West Coast.	East Coast.	Range.
January .						
July . .						

Explain why the influence of a cold current is more pronounced in summer than in winter. How does the difference in latitude between the south-west of Australia and the extreme south of South America help to explain why the Peruvian current is colder than the West Australian current ?

18. Complete the following statement in your notebook :

Only the extreme south-west of Western Australia, Tasmania, and the southern half of Victoria have a temperature below ° F. in summer ; the temperature over the greater part of the continent exceeds ° F. during the hottest month. In winter only the north has a temperature exceeding ° F., while Tasmania, Victoria, the mountains and interior lowlands of New South Wales have a temperature below ° F. New Guinea is hot throughout the year, its temperature being about ° F. at all seasons.

New Zealand has an equable climate. Its summer temperature ranges from ° F. in the north to ° F. in the south. In winter the temperature ranges from ° F. in the north to ° F. in the south. Owing to their great height the New Zealand Alps are covered with snow throughout the year.

Winds and Rainfall

19. Figs. 43 and 44 show the position of the three southern continents in relation to the wind and pressure belts. Write short revision notes explaining (i) why the trade-wind and horse-latitudes belts are dry ; (ii) why the Doldrums and westerly-wind belts are wet ; (iii) why the belts occupy different positions in summer and in winter.

20. Figs. 47 to 52 show the influence of (i) the moving of the belts, (ii) the relief, (iii) summer heat, (iv) cyclones, upon the rainfall of Australia, New Zealand, and New Guinea. The wet regions are shaded. Compare Figs. 43 and 44 with the actual rainfall maps (Figs. 51 and 52) and enter the following in your notebook, inserting the omissions :

(*a*) The northern half of New Guinea is wet both in summer and in winter because it lies in the belt both in January and July.

(*b*) The southern half of New Guinea is wet in summer because at that season it lies in the belt. (Its winter rainfall is explained in question 21.)

(*c*) Tasmania and South Island, New Zealand, are wet in summer and winter because they lie in the belt throughout the year.

(*d*) The north of Australia is wet in summer and dry in winter because in summer it lies in the belt and in winter in the belt.

(*e*) The south-west of Australia, the extreme south of South Australia, and the south-west of Victoria are dry in summer and wet in winter because in summer these regions lie in the belt and in winter in the belt.

(*f*) North Island, New Zealand, is wet in winter because it then lies in the belt. (Its summer rainfall is explained in question 25.)

(*g*) The greater part of Australia north of lat. 30 is dry in winter because at that season this region lies in the and belts. (The summer rainfall of the east coast is explained in question 23.)

21. The influence of relief upon rainfall is seen in Figs. 47 and 48. You have learned that where trade-winds blowing from the sea encounter a bold coast or highlands, rain falls. How does the configuration of the land help to explain the winter rainfall of the south-east of New Guinea and of the east coast of Queensland ?

22. Account for the difference in the average rainfall of the following places :

		Latitude.	Annual rainfall.
		degs.	ins
I.	Hobart . . .	43	23
	West coast of Tasmania . . .	43	103
II	Christchurch (N.Z.) .	43	25
	Hokitika (N.Z.) .	42	116

23. The following regions, although lying in the westerly-wind belt in winter, have little or no rain in winter. Account for this.

(i) East of the Darling Range, Western Australia.

(ii) Lowlands lying between the Flinders Range and the highlands of New South Wales.

24. What effect has intense heat upon atmospheric pressure ? Fig. 50 shows how the intense summer heat influences the direction of winds and the distribution of rainfall. Notice that the summer rain region extends southwards (i.e. polewards), and that the trade-winds are deflected towards the coast of Queensland, giving rain to the whole of the east of Queensland. Notice also that the south coast receives little or no rain at this season, because

FIGS. 45 AND 46

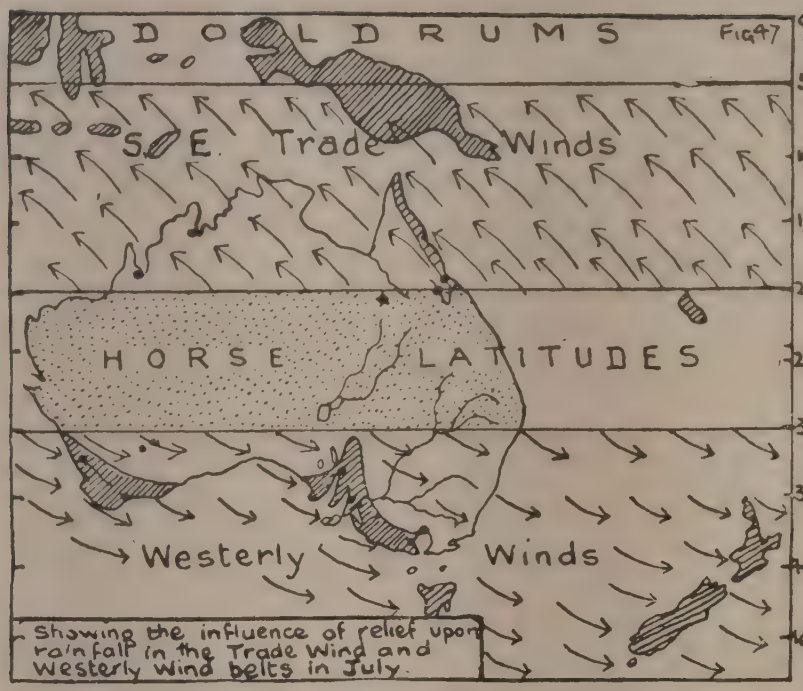


Fig 47

Showing the influence of relief upon rainfall in the Trade Wind and Westerly Wind belts in July.

Fig 48

The same in January

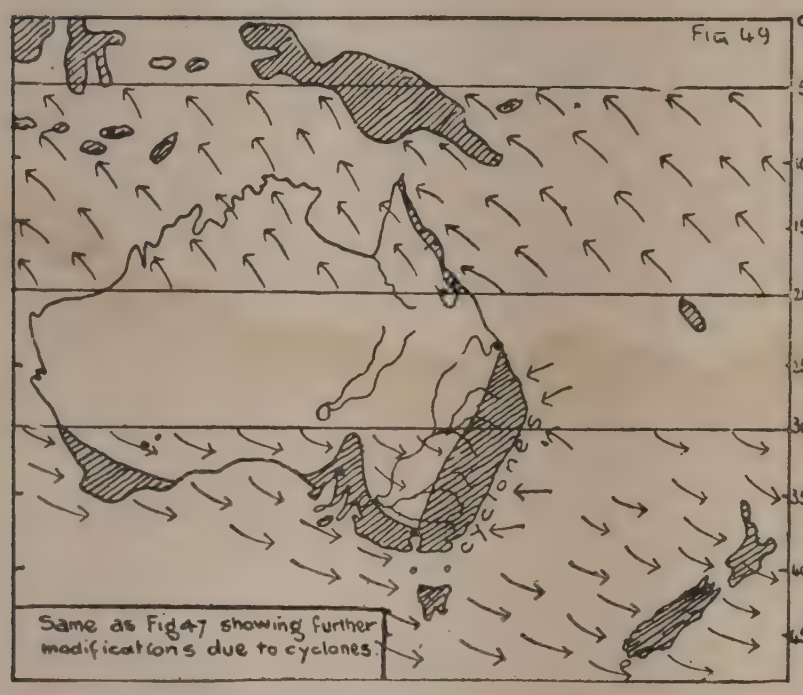


Fig 49

Same as Fig 47 showing further modifications due to cyclones.

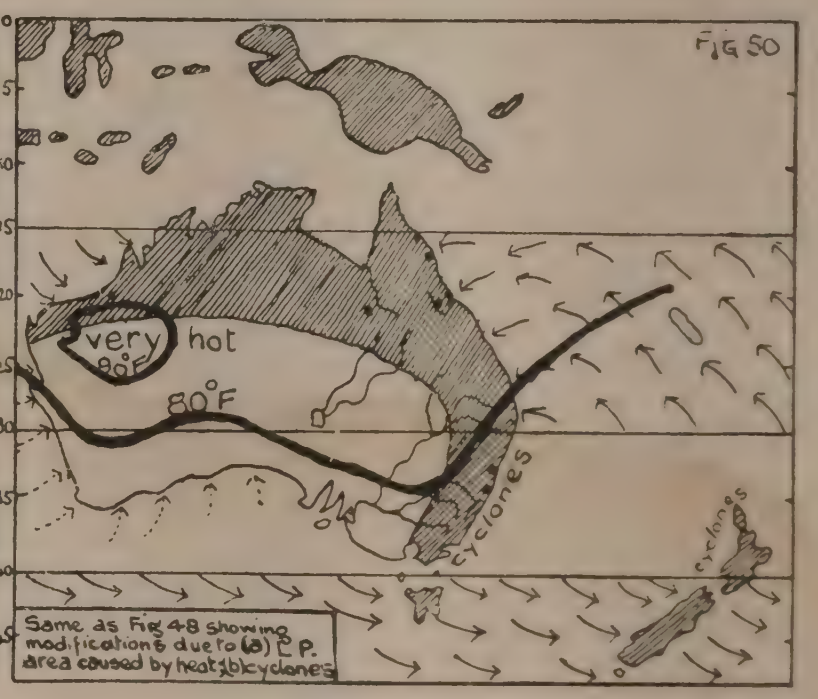


Fig 50

Same as Fig 48 showing modifications due to (a) L.P. area caused by heat (b) cyclones

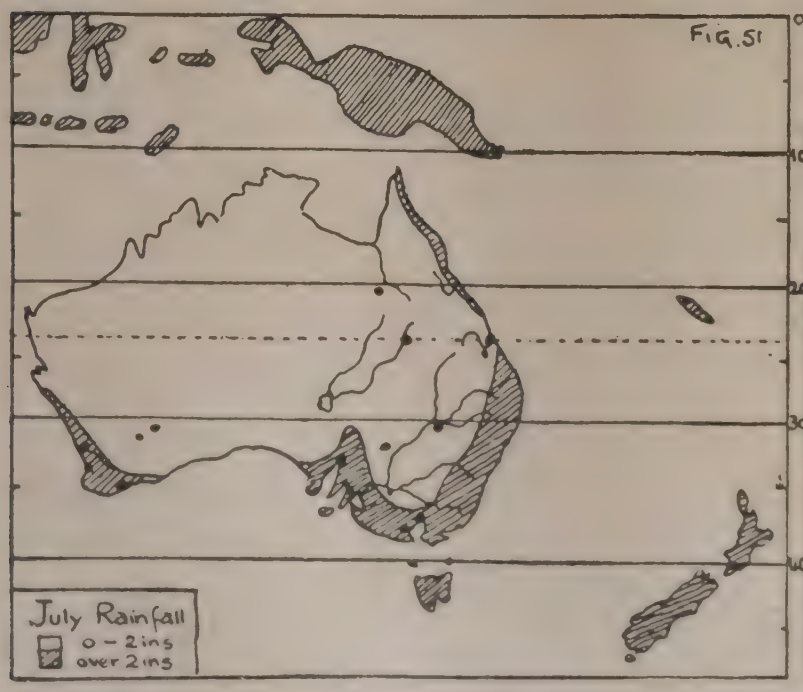


Fig. 51

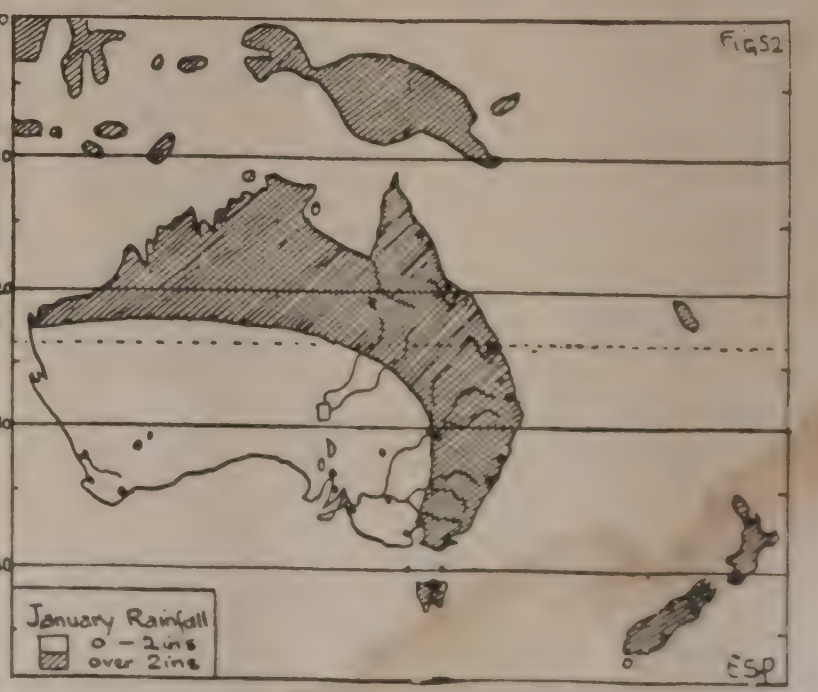
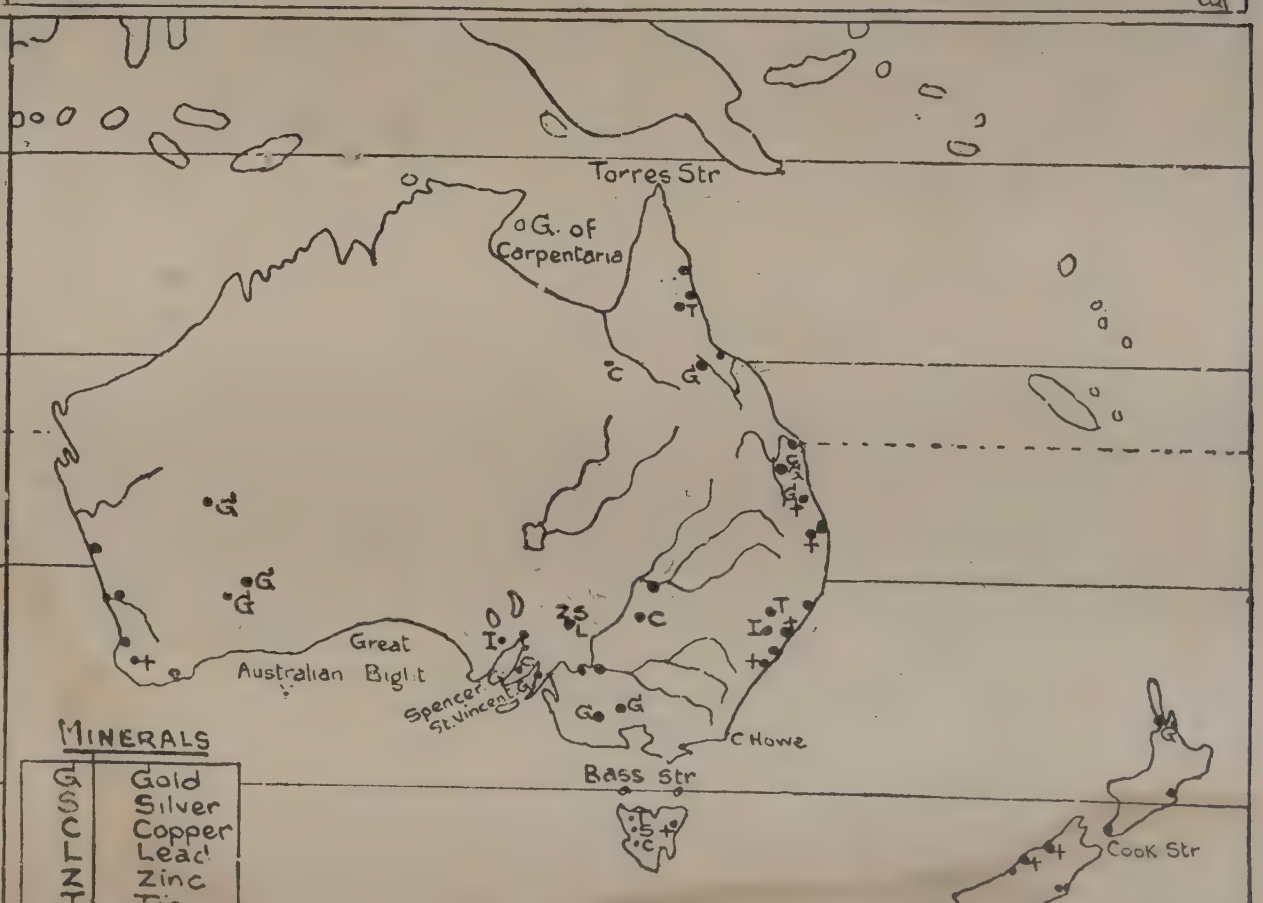


Fig 52

FIG. 53.

FIG. 54.

FIG. 55.



it lies in the horse-latitudes belt, and any winds moving from this belt towards the interior will be dry because they are fed by the descending air of the horse-latitudes belt.

The west coast receives little or no rain from the air which moves from the west towards the heated interior. State how the cold West Australian current is responsible for this.

25. Figs. 49 and 50 also show the regions affected by cyclones. These maps will help you to account for the summer rainfall of North Island, N.Z., and for the winter rainfall of the eastern half of New South Wales. Enter your explanation in your notebook.

26. Figs. 53 and 54 are the seasonal and annual rainfall maps. Account for the seasonal distribution of rain at the following places:

ANNUAL RAINFALL

—	Jan.	Feb.	March.	Winter. April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
Brisbane .	7·6	7·0	6·7	3·3	3·0	2·1	2·2	2·4	2·2	2·7	3·7	5·0
Sydney .	3 6	4 9	5·1	5·6	5·2	5·5	4·7	3·2	3·0	3·0	3·1	2·5
Auckland	7·5	5·8	1·0	2·9	4·0	3·6	6·3	6·4	5 4	5·0	1·1	5·2
Perth .	0·3	0·3	0·8	1·7	4·9	6·6	6·2	5·6	3 3	2·1	0·8	0·6

27. Enter the following in your notebook, inserting the omissions:

The north and east coasts of Australia receive an average annual rainfall of at least inches, most of which, in the north and north-east, falls in . This amount rapidly decreases inland both towards the south and towards the west. Over part of the central plain and over most of the western plateau the rainfall does not exceed inches per year. In the region of winter rainfall, the south-west corner of Western Australia and part of Victoria have over inches, but elsewhere less than that amount falls. The west of Tasmania and the west of South Island receive more than inches per year; the east coasts of these two islands have less than inches. Most of North Island, N.Z., receives over inches per year.

P. 28. Make a tracing of the outline and of the 10-in. **isohyet** of Australia (Fig. 54). Transfer the tracing to squared paper and calculate what percentage of Australia receives less than 10 ins. of rain per year.

Drainage

29. You have learned elsewhere that some of the rain which falls to the earth sinks into the soil and passes underground wherever the rocks are porous; some is evaporated, and the remainder runs off the surface and finds its way into the rivers, lakes, etc. Examine the rainfall maps and the orographical map and explain the following facts: (*a*) No rivers flow into the Great Australian Bight; (*b*) no permanent rivers from the north-west of New South Wales enter the Darling for some 250 miles above Wentworth; (*c*) the rivers flowing from the Queensland highlands diminish in volume as they flow westwards and in winter are only a chain of pools; (*d*) the rivers of Western Australia are few in number and seldom contain much water: of these the Swan River has the most constant supply; (*e*) the northern rivers have a greater volume in summer than in winter; (*f*) the rivers of the east of Australia, Tasmania, and New Zealand have a constant supply of water; (*g*) the Murray River is navigable as far as Albury for the greater part of the year; (*h*) Lakes Eyre, Torrens, and Gardner are usually not continuous sheets of water, but chains of swamps and pools of salt water.

30. With the help of the orographical map explain the following facts: (*a*) The Murray, Murrumbidgee, and the rivers of the east coast deposit large quantities of alluvium where they leave the highlands for the plains; (*b*) the bed of the River Murray is, in many places, above the level of the surrounding plain; (*c*) after heavy rainfall and after sudden thaws in the Australian Alps the Murray Plain is often flooded; (*d*) after entering South Australia the Murray turns suddenly southwards; (*e*) the upper waters of the Murray and Murrumbidgee

have cut deep gorges in the highlands; (*f*) the Clutha, Waitaki, Waikato, and Thames are the chief rivers of New Zealand; (*g*) the Burdekin, Fitzroy, and Hunter are the chief rivers of the east coast of Australia.

31. Draw a full-page map of Australia and mark upon it the rivers named in question 30. Mark also one important town on each river.

32. Draw a full-page map of the Murray basin and describe the course of the river and of its chief tributaries. Notice that a sandbar prevents all save very small vessels from entering the river from the sea.

CHAPTER VI

ARTESIAN WELLS, VEGETATION, AND ANIMALS

P. 1. DESCRIBE an experiment to show that water finds its own level. How does this property of a liquid enable water to be supplied to a town?

P. 2. Describe, with sketch, the action of the common lift pump.

P. 3. Procure a piece of lead pipe or rubber tubing (Fig. 57). At B insert a tight-fitting cork. Hold the pipe as shown in the figure, and fill it with water. Bore a small hole at C. What happens?

FIG. 57.

G. 4. No country can ever be densely peopled if the water-supply is deficient. It is evident, therefore, that the future of the larger portion of Australia is controlled by the question of water-supply.

Draw a diagram to show graphically what percentage of the continent of Australia receives (*a*) less than 10 ins., (*b*) from 10 to 20 ins., (*c*) over 20 ins. of rain per annum, from the following figures; (i) less than 10 ins., 38 per cent.; (ii) 10 to 20 ins., 32 per cent.; (iii) over 20 ins., 30 per cent.

5. Although little can ever be done to reclaim the vast region included within the 10-in. isohyet, the deficiency in other parts is being partly met either by tapping underground water or by constructing reservoirs. Fig. 60 shows the regions where underground water is known to exist. Mark the position of these **"artesian basins"** on the last map drawn by you. Describe the position of the largest artesian area.

6. You have learned (*a*) that sedimentary rocks are not always horizontal, (*b*) that some rocks are porous. Fig. 57 and question 3 will help you to understand how water passes underground and how, by boring, this water can be made to rise to the surface.

Fig. 58 is a block model showing a piece of country and the underlying rocks. A and C

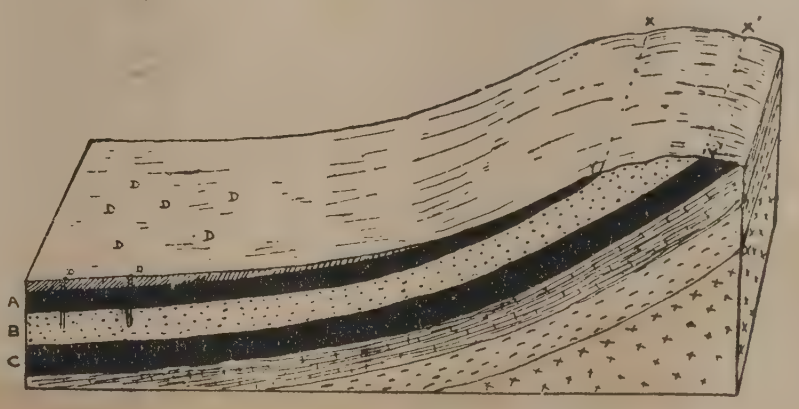


FIG. 58.

represent layers of impermeable rock, B represents layers of porous rock. The rock B outcrops at the surface between the dotted lines XY and X′Y′. Rain falling upon the surface between the lines XY and X′Y′ will sink into the ground and pass downwards towards the letter B. The water cannot sink through rock C. As a result the porous rock B may become practically filled with water. D D are borings sunk through the impermeable rock A into the water-bearing rock B. Now, if the level of the water in the rock B is higher than the earth's surface at D D, the water will rise to the surface, and the pressure may be sufficient to raise the water to a great height. (In some bores the water does not rise to the surface, making pumping operations necessary.)

There are more than 4,500 artesian wells in Queensland and New South Wales, two-thirds of which are in Queensland. There are over forty bores in the Wimmera district of Victoria. The biggest bore yields 4,500,000 gallons of water a day.

Artesian water, although suitable for animals, is often useless for growing crops, on account of minerals contained in solution.

Copy Fig. 58 into your notebook and explain the diagram.

7. Draw a diagram to show why pumping operations are necessary at many collieries.

8. Describe the physical conditions which favour the construction of reservoirs in the upper courses of the Murray and Murrumbidgee.

The gorge of the Murrumbidgee is 800 to 1,000 feet high. Here a dam has been built across the gorge, converting the valley into a lake 40 miles long and 240 feet deep. In the same way a reservoir has been constructed in the Darling Range to supply water to the population of the district around Kalgoorlie.

Vegetation

9. Below is a summary of the main conclusions arrived at after discussing the vegetation of South America (see Figs. 68 to 74).

Vegetation Regions of South America

Region.	Temperature.	Rainfall.	Products
Equatorial Forest .	Hot all seasons.	Heavy rain all seasons.	Rubber, bananas, sugar, maize, manioc, cocoa, coffee, vanilla, tobacco, cotton.
Warm Temperate Forest	Hot summers, cool winters.	Most rain in summer.	Maize, fruits, tobacco, wine, wheat.
Mediterranean Forest .	Hot summers, warm winters.	Most rain in winter.	Wheat, vine, fruits, sheep.
Cool Temperate Forest	Warm summers, cool or cold winters.	Rain all seasons.	Timber, fur animals, fishing, fruits.
Savanna . . .	Hot all seasons.	Most rain in summer.	Cattle (tropical products with irrigation—cotton, maize, rice, sugar, fruits).
Steppes . . .	Hot or warm summers, cool or cold winters.	Most rain in summer.	Cattle, sheep, horses, wheat, flax.
Scrub (Tropical) .	Always hot.	Long dry season.	(Tropical products with irrigation.)
Desert (Tropical) .	Warm winter, hot or very hot summer.	No rain.	(Tropical products with irrigation.)

Copy the above summary into your notebook, adding a further column, in which you should enter the regions where the different types of vegetation are found in South America.

P. 10. Instead of actual figures, the following words are sometimes used in describing the climate of a region:

Temperature.		Rainfall.	
Under 32° F. .	cold	Under 10 ins. .	scanty
32° F. to 50° F.	cool	10 ins. to 20 ins.	light
50° F. ,, 68° F.	warm	20 ins. ,, 40 ins.	moderate
68° F. ,, 86° F.	hot	40 ins. ,, 80 ins.	heavy
Over 86° F. .	very hot	Over 80 ins. .	very heavy

Convert the above temperatures into the Centigrade scale and the rainfall into millimetres.

11. With the help of your atlas and of the climatic and vegetation maps, draw up a summary for Australia, New Zealand, and New Guinea similar to the one (question 9) already entered in your notebook for South America. Omit filling in the "Products" column for the present. Compare the climatic conditions of the different vegetation regions with those of South America. What do you notice?

*__12.__ Although the vegetation regions of the continents bear similar names, the character of the vegetation varies from continent to continent. Refer to books in the school library or to any other available source for descriptive accounts of the vegetation of Australia and New Zealand. Write short notes on each of the following: Eucalyptus, jarrah, karri, mallee, wattle, mulga, salt bush, spinifex, kauri, New Zealand flax, sandal wood.

*__13.__ Write a short account of the native animal life of Australia, New Zealand, and New Guinea.

G.D. 14. In 1788 Captain Philip landed in Australia with twenty-nine sheep and six cattle. There are now 17,000,000 cattle and 100,000,000 sheep in Australia and New Zealand. The percentage of cattle and sheep in each state is given below:

—	Cattle.	Sheep.
New South Wales.	20 per cent.	34 per cent.
Queensland . .	40 ,,	16 ,,
Victoria . .	9 ,,	12 ,,
Northern Territory	4 ,,	—
South Australia .	2 ,,	5 ,,
Tasmania . .	2 ,,	2 ,,
Western Australia	3 ,,	6 ,,
New Zealand .	20 ,,	25 ,,

Draw diagrams to show the above percentages graphically.

15. Examine the distribution maps (Figs. 61 and 62) to find the regions where cattle and sheep are most important.

16. "Cattle stand heat and moisture better than sheep and require better pasture." Do the climatic and distribution maps of Australia and of South America confirm this statement? Explain.

17. Write a connected account of the distribution of cattle in Australia and New Zealand. Include in your account (*a*) the importance of artesian water in the dry season; (*b*) an explanation of the fact that Queensland contains twice as many cattle as New South Wales; (*c*) an explanation of the fact that three-quarters of the cattle of New Zealand are in North Island.

18. Write an account of the distribution of sheep, explaining why New South Wales has more than twice as many sheep as Queensland, and why the number of sheep in New Zealand are evenly distributed between North and South Island.

A. 19. From the figures given in question 14, find, in round numbers, the number of cattle in (*a*) Queensland, (*b*) Victoria.

A. 20. 44 per cent. of the cattle of Victoria are dairy cattle, while only 7 per cent. of the cattle of Queensland are dairy cattle. Find the number of dairy cattle in each of the two states.

21. Fig. 62 shows the distribution of dairy cattle. Explain (*a*) why the percentage of dairy cattle is greater in Victoria than in Queensland; (*b*) why most of the dairy farms are situated near the coast.

A. 22. From the following figures find, to the nearest whole number, (*a*) how many times larger Australia is than Great Britain; (*b*) how many times larger the Argentine is than Great Britain; (*c*) the percentage of arable land in Great Britain, Australia, New Zealand, Argentina. Enter your answers in your notebook in tabular form:

—	Area.	Arable land.
	sq. miles.	acres.
Great Britain .	88,745	15,500,000
Australia . .	2,974,581	13,300,000
New Zealand .	103,581	1,500,000
Argentina . .	1,153,119	59,700,000

23. The table on p. 38 gives, in round numbers, the agricultural production for 1910

FIG. 59.

FIG. 60.

FIG. 61.

FIG. 62.

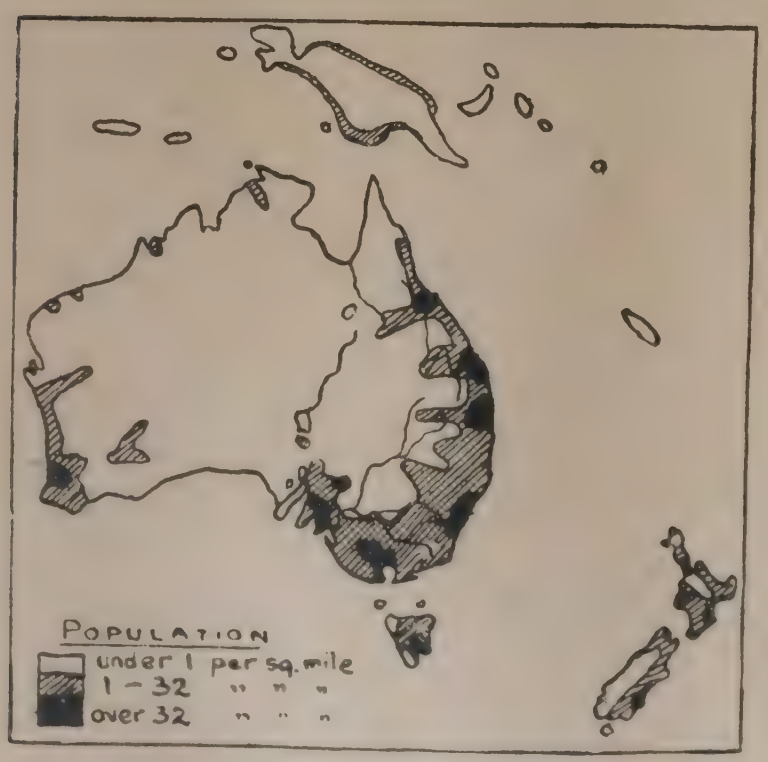


FIG. 63.

FIG. 64.

copra
pearls
pearls
cattle
cattle
cattle
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pearls
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cattle
cattle

—	Wheat.	Maize.	Wine.	Sugar.	Tobacco.	Cotton.	Coffee.
	1,000 bus.	1,000 bus.	1,000 galls.	1,000 cwts.	1,000 lbs.	1,000 lbs.	1,000 lbs.
New South Wales .	18,325	2,091	556	2,104	2,347	—	—
Victoria . . .	25,240	500	1,512	—	204	—	—
S. Australia . .	14,947	—	5,086	—	—	—	—
N. Territory . .	—	—	—	—	—	—	—
W. Australia . .	11,223	—	162	—	—	—	—
Tasmania . . .	214	—	—	—	—	—	—
Queensland . .	312	1,831	48	3,243	197	27	16
New Zealand . .	6,568	500	100	—	—	—	—

(Note.—Queensland produced 4,106,000 bus. of maize in 1918.)

Name the states which produce most wheat. Examine the distribution map (Fig. 59) and state in which parts of the different states

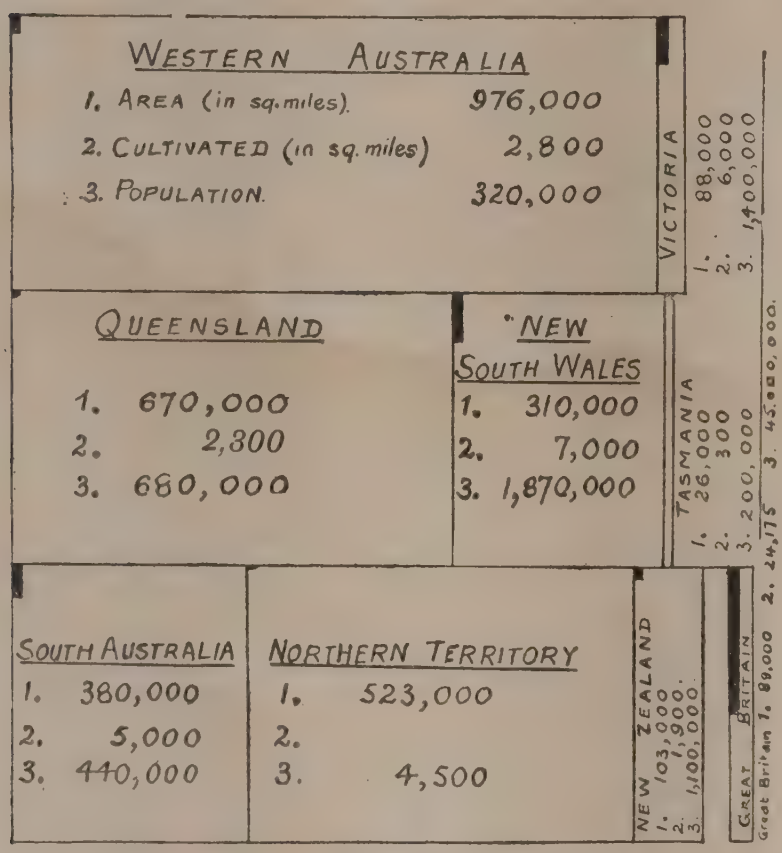

FIG. 66.

wheat is largely grown. What are the geographical conditions which favour the cultivation of wheat in the regions named ?

24. Examine Fig. 65 and deal similarly with each of the products named in the table in question 23, that is, state in which parts of the different states the product is grown and name the geographical conditions which favour the cultivation of the product.

25. Complete question 11 by filling in the products column. Compare your answer to question 11 with the table for South America given in question 9. Are the crops, which are grown in both Australia and South America, cultivated in the same vegetation regions ?

26. Compare the climate of Mildura and Renmark with that of Mendoza, South America. What crops are grown in these districts ? How is water obtained in each case ?

A. 27. The total area of each state and the area devoted to agriculture in 1915 is graphically shown in Fig. 66. The population of each state is also given. Calculate the density of population per square mile. Enter your answers in your notebook. Write a brief summary of some of the facts established by the diagram.

28. More than half of the cultivated area of New Zealand is devoted to turnips and mangolds. Are you able to give any reasons to account for this ?

***29.** Tropical products are not extensively grown in Australia. To what extent is the policy of "white Australia" accountable for this ? If coloured immigrants were extensively admitted, where would they be likely to settle and what would be their chief occupations ?

CHAPTER VII

MINERALS, COMMUNICATIONS, POPULATION, REVISION

1. AUSTRALIA is rich in minerals, yet it is well to bear in mind that, at present, only two per cent. of the population is engaged in mining. The value of the mineral output of Australia and New Zealand in 1918 was:

—	Australia.	New Zealand.
Coal . . .	£6,124,000	£2,693,000
Gold . . .	£5,408,000	£1,334,000
Silver and lead .	£6,105,000	£103,000
Copper . .	£4,465,000	—
Tin . . .	£1,432,000	—

Although the output of iron is increasing rapidly since 1918, the total value of the output did not reach £1,000,000 in 1918.

The following table shows the percentage of the total value of the minerals produced.

	Coal.	Gold.	Silver.	Copper.	Tin
New South Wales .	70	6	64	16	26
Victoria .	3	14	2	—	12
South Australia .	—	—	—	17	—
Northern Territory .	—	under 1	—	2	2
Western Australia .	2	52	4	3	8
Tasmania .	1	under 1	10	18	27
Queensland .	8	10	4	44	25
New Zealand.	16	17	16	—	—

Write a brief summary of the facts established by the above figures.

G.D. 2. Draw diagrams to represent the above percentages graphically. Above each diagram write the total value of the mineral represented.

3. Copy the outline of Fig. 65 and mark on the map the positions of the mining towns and districts named in the lists below. Insert also the initial letter of the mineral referred to, e.g. G for gold, T for tin. Represent coal as shown in Fig. 65.

Coal . (N.S.W.) Newcastle, Bulli; (Q.) Ipswich Gympie; (W.A.) Collie; (Tas.) Fingal; (N.Z.) Greymouth, Westport.
Iron . (S.A.) Iron Knob; (N.S.W.) Lithgow.
Gold . (W.A.) Coolgardie, Kalgoorlie, Murchison; (V.) Bendigo, Ballarat; (Q.) Charters Towers, Mount Morgan, Gympie; (N.Z.) Otago, Auckland.
Silver (N.S.W.) Broken Hill; (Tas.) Zeehan.
Zinc . (N.S.W.) Broken Hill.
Tin . (Q.) Herberton; (Tas.) Mount Bishchoff; (N.S.W.) Tamworth.
Copper (N.S.W.) Cobar; (Q.) Cloncurry, Mount Morgan; (Tas.) Mount Lyell; (S.A.) Wallaroo.

4. Mark on the same map the following railway lines: (*a*) Cairns to Charleston, via Herberton, (*b*) Townsville to Cloncurry, (*c*) Rockhampton to Longreach, (*d*) Rockhampton to Mount Morgan, (*e*) Brisbane to Cunnamulla, (*f*) Sydney to Bourke and Cobar, (*g*) Sydney to Hay, (*h*) Port Pirie to Broken Hill, (*i*) Geraldton to Murchison Goldfield, (*j*) Port Adelaide to Morgan, (*k*) Melbourne to Deniliquin, (*l*) Melbourne to Mildura, (*m*) the through route from Perth to Brisbane. (See Fig. 67.)

5. Notice the large number of separate lines which run inland from the coast. Compare the railways of Australia with those of South America in this respect.

6. Draw a full-page map of New Zealand and mark on it the position of the following railway lines: (*a*) Wellington to Auckland and to Napier; (*b*) Invercargill to Lake Wakatipu; (*c*) Invercargill via Dunedin to Christchurch; (*d*) Christchurch to Arthur's Pass; (*e*) the short railways on the west of South Island.

7. In new countries regions favourable to wheat cultivation have the greatest mileage of railways. Suggest reasons for this and examine Fig. 67 for confirmation of the statement.

8. Although it is now possible to proceed by rail from Perth to Brisbane, the lack of uniformity in the railway gauges is a serious drawback. In Queensland the gauge is 3 ft. 6 ins., in New

P.D.
P.C
To Fiji & Vancouver
To San Francisco
To Panama
Colombo to Freemantle
Cape Town to Melbourne
COMMUNICATIONS
0 200 400 800 miles
ESP

FIG. 67.

South Wales 4 ft. 8½ ins., in Victoria 5 ft. 3 ins., in Western Australia 3 ft. 6 ins., and in South Australia all three gauges are found. In 1897 the unification of the railways could be accomplished for £2,500,000; to-day (1925) the cost is £57,000,000. What is the chief reason for the great increase in the cost?

9. Explain why camel transport is largely used in the interior of Western Australia.

A. 10. In 1921 the population of Australia was 5,436,794. The population of the capitals at the same time was: Sydney, 905,947; Melbourne, 795,100; Adelaide, 260,542; Brisbane, 209,699; Perth, 154,866; Hobart, 52,163. What percentage of the total population lived in the capitals?

A. 11. In 1921 the population of New Zealand was 1,218,913. The population of the following towns at the same time was: Auckland, 164,450; Wellington, 110,680; Christchurch, 110,201; Dunedin, 73,470. What percentage of the total lived in these four towns?

12. Compare the population map (Fig. 63) with the vegetation map (Fig. 55), and state in which vegetation regions the population is densest.

***13.** To what extent is the sparse population of Australia due to the (*a*) location of the continent relative to other continents, (*b*) relief, (*c*) climate, (*d*) policy of "white Australia"?

14. In what parts of Australia is the density of population over two persons per square mile? Account for the fact that most of the people of Australia live in the parts you name.

15. What geographical facts affect the distribution of population in New Zealand?

A. 16. From the table of Australian exports for 1919, find the total value of each of the following classes of products: (*a*) agricultural, (*b*) animal, (*c*) mineral.

G.D. 17. Draw rectangles to scale to represent each of the above totals.

G.D. 18. Draw rectangles to scale to represent the total value of each of the above classes of products exported from New Zealand in 1919.

EXPORTS.

—	Australia.	New Zealand.
	£1,000	£1,000
Wool	42,767	19,560
Wheat	11,335	—
Skins and hides	4,396	3,439
Butter	3,193	5,400
Copper	2,393	—
Zinc	429	—
Tallow	2,171	2,680
Meat	5,055	10,912
Flour	5,819	—
Timber	237	—
Coal	387	201
Silver and lead	4,800	103 (silver alone)
Tin	984	—
Gold	5,000	1,334
Cheese	—	5,871
Flax	—	908
Kauri gum	—	256
Total value of ALL exports	113,964	53,970

IMPORTS.

—	Australia.	New Zealand.
	£1,000	£1,000
Yarns, clothing, and textiles	33,548	7,560
Machinery, wire and metal goods	16,996	2,490
Drugs, chemicals, and manure	4,425	1,099
Bags and sacks	3,935	455
Petrol and oil	2,500	1,305
Rubber goods	1,688	—
Paper and books	4,370	1,299
Sugar	1,052	1,114
Tea	1,955	423
Spirits	1,263	587
Tobacco	1,865	1,014
Arms and explosives	877	—
Timber	1,837	—
Wheat	—	397
Total value of ALL imports	102,335	30,671

19. Manufacturing on a large scale can only be carried on where population is dense. How does the table of imports support this statement?

20. Draw sketch maps of the districts around Melbourne, Sydney, and Wellington. Mark on these maps the geographical facts which

Fig 68

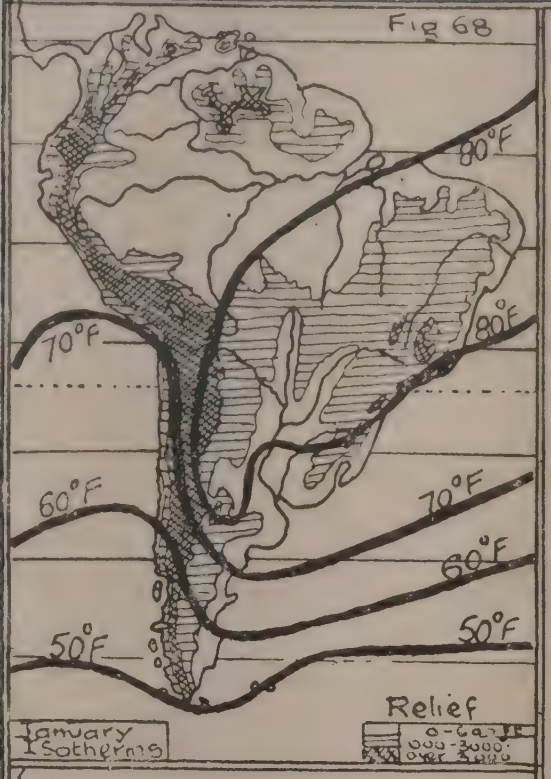

Fig 69

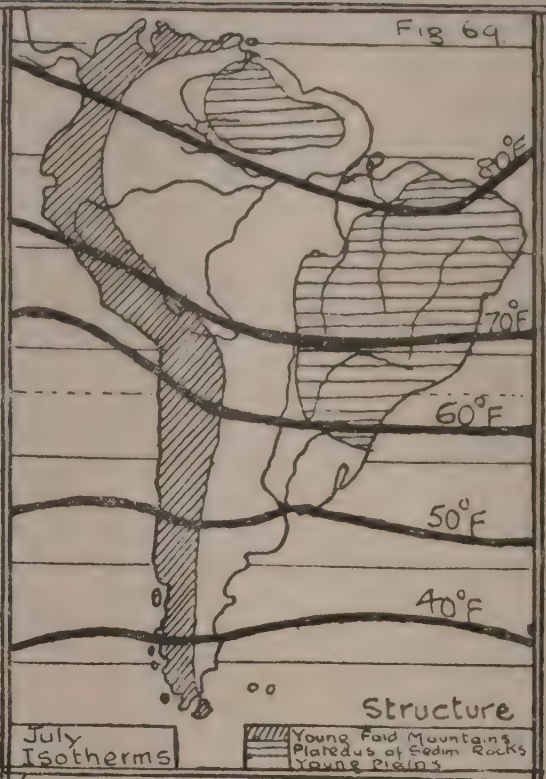

Fig 70

Fig 71

Fig 72

Fig 73

Fig 74

Fig 75

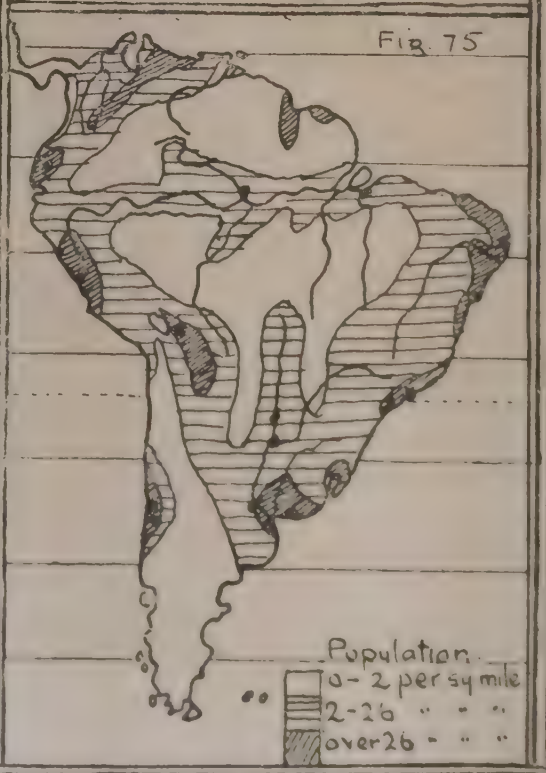

Fig 76

account for the position and development of these towns.

21. Draw up a table to show the ports of Australia and New Zealand and their exports (Fig. 65).

***22.** Write short notes on the discovery and exploration of Australia, and mark on an outline map the routes followed by Eyre, Sturt, Cook, and Stuart (Fig. 64). Before answering this question, refer to books in the school library for first-hand accounts of some of the explorations.

***23.** Write a brief account of the political development of Australia. What is meant by (*a*) Commonwealth of Australia, (*b*) Federal Territory ?

***24.** Examine the boundaries of the Australian states. Some are natural, others are artificial. What is the character of the boundary between (*a*) South Australia and New South Wales, (*b*) Victoria and New South Wales, (*c*) Tasmania and Victoria, (*d*) Victoria and South Australia ? Which of the boundaries appear to be parallels of latitude or meridians of longitude ? Can you suggest why these are called "astronomical boundaries" ?

***25.** Describe the life of (*a*) the Papuans of New Guinea, (*b*) the Maoris of New Zealand, (*c*) the aborigines of Australia. In each case show how far their present condition or past condition or both is due to geographical causes.

26. Write a summary of the geography of Australia and New Zealand under the following heads: (*a*) Position and area, (*b*) relief and drainage, (*c*) climate, (*d*) vegetation and crops, (*e*) animals and pastoral products, (*f*) minerals and manufactures, (*g*) communications, transport, and trade, (*h*) distribution of population and sites of towns.

R. B. A. N. M.'S EDUCATIONAL QUARTERS
No.....
Date.....
BANGALORE.

AFRICA

CHAPTER VIII

LOCATION, AREA RELIEF, LAND FORMS

1. WITH the help of your atlas and of the globe complete the following statement in your notebook :

Africa is a compact mass of land lying to the south of Europe, from which it is separated by the Sea. The Straits of , between Africa and Spain, are only miles wide. Between Africa and Arabia is the Sea. The Red Sea is narrowest at the Straits of . To the west of Africa lies the Ocean. The east coast is washed by the Ocean. The cutting of the Canal has converted Africa from a peninsula into an island. Africa extends from lat. ° N. to lat. ° S., a distance of about miles. The equator passes through the north of Nyanza. The Tropic of Cancer passes through the Desert, and the Tropic of Capricorn passes through the Desert and through the southern part of the Island of , which is separated from the mainland by the Channel. The width of the continent from Cape Verde to Cape Guardafui is about miles. South of Cape Verde a great bend forming the Gulf of causes the width to narrow to miles. Longitude 20° E. passes through Cape on the south coast and through the extreme east of the Gulf of on the north coast.

2. Copy the outline of Fig. 77 and mark upon it the names and facts contained in your answer to question 1.

G.D. 3. The area of Africa is roughly 11,500,000 sq. miles, of South America 7,000,000, and of Australia 3,000,000. Draw three rectangles to represent these areas graphically.

4. Open your atlas to the relief map of Africa. Notice that (*a*) there are high mountains in the north-west ; (*b*) most of the remainder of Africa, north of a line drawn from Cape Frio on the west coast to Suakin on the Red Sea, is a plateau, from 600 to 1,500 ft. above the sea-level ; (*c*) on this plateau there are two belts of higher land, one extending across its centre from south-east to north-west, and another running parallel to the coast of Upper and Lower Guinea. (*d*) South of the line from Cape Frio to Suakin most of the land is over 3,000 ft. high, and in the extreme south and east there are extensive areas over 6,000 ft. high.

5. On an outline map of Africa draw the 600, 1,500, 3,000, and 6,000 ft. contours. Shade or colour the map to show the relief.

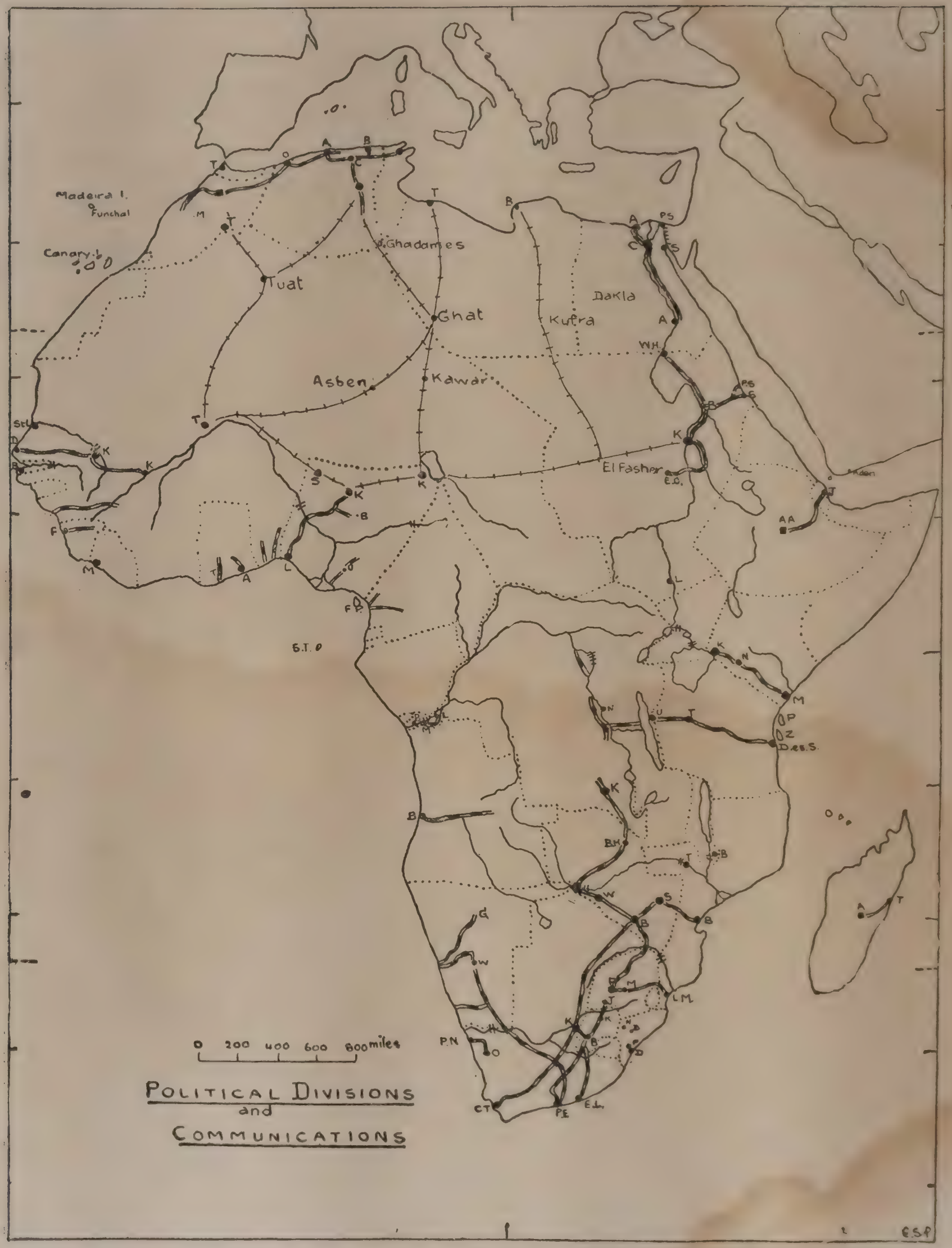
Madeira I.
Funchal
Canary I.
Tuat
Ghadames
Ghat
Asben
Kawar
Kufra
Dakla
El Fasher
Aden
0 200 400 600 800 miles
POLITICAL DIVISIONS
and
COMMUNICATIONS

FIG. 77.

6. Draw sections across the map (1) along the equator, (2) along lat. 30° S., (3) along long. 20° E.

***7.** Refer to the school library or to any other available source for descriptive accounts of the relief features of Africa, and enter the following summary in your notebook :

The relief features of Africa fall into three divisions: (i) the mountains of the north-west, (ii) the plateau, (iii) the highlands of the extreme south.

(i) The mountains of the north-west are called the Atlas Mts. They consist of several mountain chains running parallel to the coast, and are similar in character to the Andes and the New Zealand Alps. They rise steeply from the coast and are broadest and highest in the south-west, where they rise to over 14,000 ft. South of the coast ranges of Algeria and Morocco is a fertile region called the Tell. To the south of the Tell the ridges enclose the Plateau of the Shotts. To the extreme south of the mountain chains is a depression, also dotted with shotts (Fig. 78).

(ii) The African plateau almost fills the whole of the continent. It rises in a series of broad terraces from north to south. It also rises steeply from the coastal lowlands and slopes gently towards the interior. From the coast, the rim of the high plateau, which is broken wherever rivers descend to the coast, has the appearance of high mountains. The Nieuwveld Mts., Quathlamba, Drakensburg Mts., Matoppo Hills, Adamawa Highlands, and Futa Jallon are some of the names given to the broken edges of the plateau. In Abyssinia, Kenya Colony, Tanganyika Territory, and in the Union of South Africa there are extensive areas over 6,000 ft. high. A remarkable feature of the plateau is a deep trench called the Great Rift Valley, which runs southwards from the Red Sea to Lake Nyasa (Fig. 91). The Rift Valley contains a number of long narrow lakes, amongst which are Lakes Rudolph, Tanganyika, and Nyasa. The Red Sea also lies in the Rift Valley. On its borders in Central Africa there are several volcanoes, including Mount Kenya (17,000 ft.) and Kilimanjaro (19,300 ft.). The Kameroon Mts. (13,000 ft.) in the west are also volcanic. Ruwenzori (17,000 ft.), another peak in Central Africa, is not a volcano.

(iii) The highlands of the south consist of ranges of mountains with valleys and plateaus, and extend from the southern edge of the High Plateau to the south coast. The narrow coastal plain in the south is separated from the Little Karroo by a broken ridge of mountains. Another broken ridge, the Zwarte Berg, separates the Little Karroo from the higher and broader plateau of the Great Karroo, which extends to the foot of the High Plateau, with its broken rim giving the Drakensburg, Quathlamba, Stormberg, and Nieuwveld Ranges.

8. Copy the map of the Atlas Region (Fig. 78) into your notebook. Colour the map to show the relief.

9. Copy the map of South Africa (Fig. 80) and colour your map to show relief, and name the features described in question 7 (iii).

10. On the map of Africa, which you have already drawn (question 5), mark the position of the Adamawa Highlands, Kameroon Mts., Matoppo Hills, Abyssinian Highlands, Drakensburg Mts., Nieuwveld Mts., Tibesti Highlands, Ruwenzori Range, Kilimanjaro, and Mount Kenya.

***11.** You have learned that the rivers of the world and the weathering agents are constantly lowering the surface of the land by wearing away the rocks. It is not difficult to imagine that if this work had continued without interruption from the beginning of time, the highlands of the earth would, ere this, have been reduced to lowlands. But high, young mountains, like the Andes, and the fact that land is slowly rising in many parts of the world, prove that there are forces at work counteracting the forces of erosion.

Give some facts to indicate that the interior of the earth—at least, that part of it which lies nearest the earth's crust—is hot and is occasionally erupted in a molten state.

12. It is generally believed that the interior of the earth is slowly cooling and contracting, and that this causes the earth s crust to crumple and fold just as the skin of a drying apple forms wrinkles.

From the following outline of a lesson and a study of Figs. 81 to 87, write an essay on the " Earth's Crust " :

(*a*) The present form of the land is due to both internal and external forces. (*b*) The external forces—viz. air, changes of temperature, freezing water, rain, rivers, waves, and ice—cause the rocks to break and decay. (*c*) Most of the rock waste is carried by rivers to the sea, where it is deposited, layer upon layer, to form new rocks (Fig. 81). (*d*) The layers are called strata, and the rocks thus formed are called **stratified** or **sedimentary rocks**. (*e*) Earth movements, due to internal forces, raise some of the strata out of the sea (Fig. 82). (*f*) The raised strata are sometimes bent into folds of different kinds (Figs. 83 and 84). (*g*) Sometimes, instead of

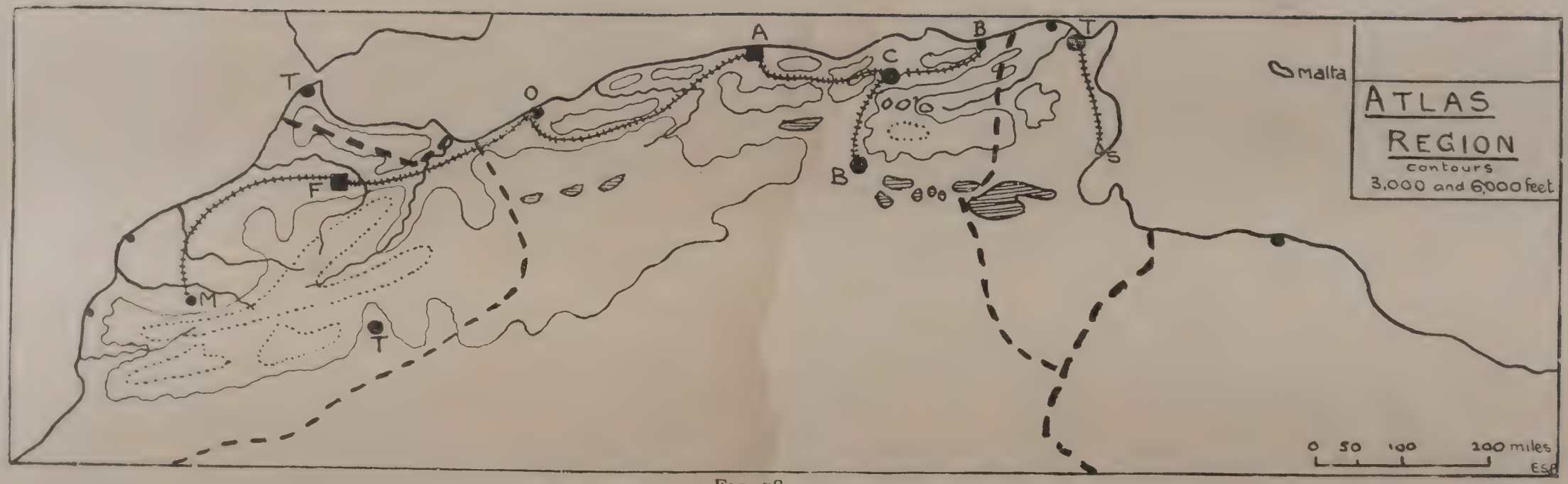
A
B
C
T
T
O
F
M
T
B
Malta
ATLAS
REGION
contours
3,000 and 6,000 feet
0 50 100 200 miles
ESP

FIG. 78.

T
K
B
Kuikoro
F
O
M
Kumasi
Takwa
A
L
I
S
K
K
Bauchi Plateau
Yidi
WEST AFRICA
contours 600, 1200, 3000 feet
0 50 100 200 300 400 miles
ESP

FIG. 79.

W
P
Middleb:
Witwatersrand
J
L M
SWAZILAND
K
N
K
B
P.N
Ookiep
Jag:
BASUTOLAND
P
D
Indwe
GR
E.L
CT
PE
SOUTH
AFRICA
Contours
600, 3,000, 4,500, 6,000 ft
0
100
200 miles
E.S.P

FIG. 80.

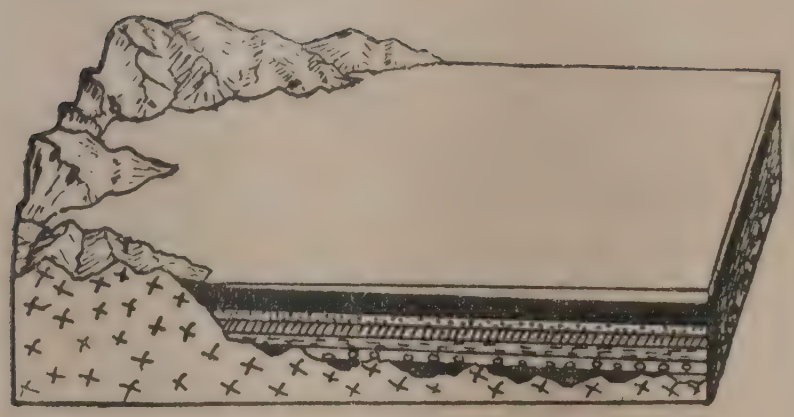

FIG. 81.

FIG. 82.

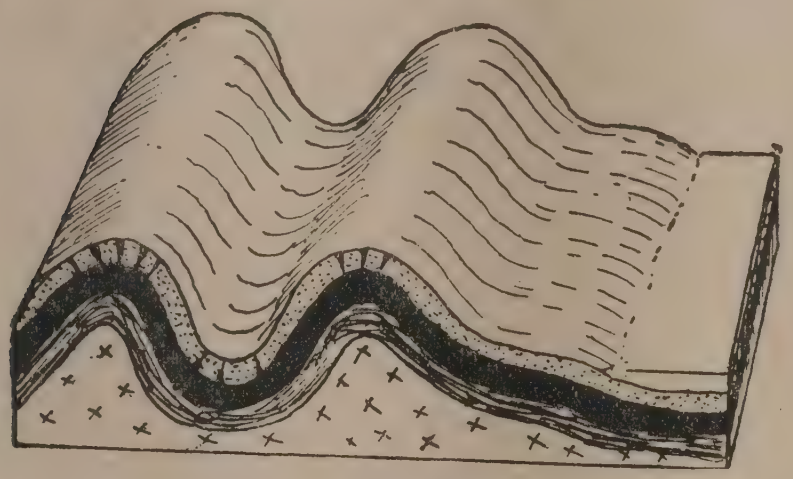

FIG. 83.

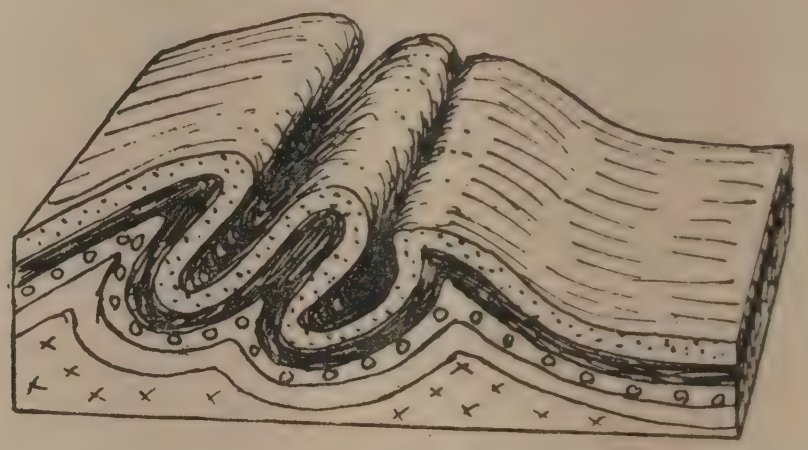

FIG. 84.

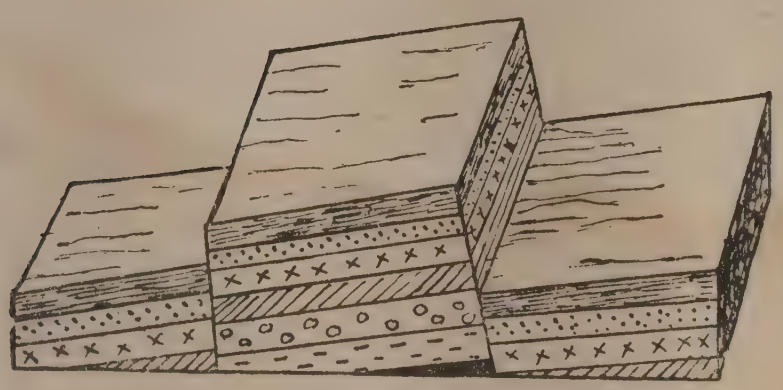

FIG. 85.

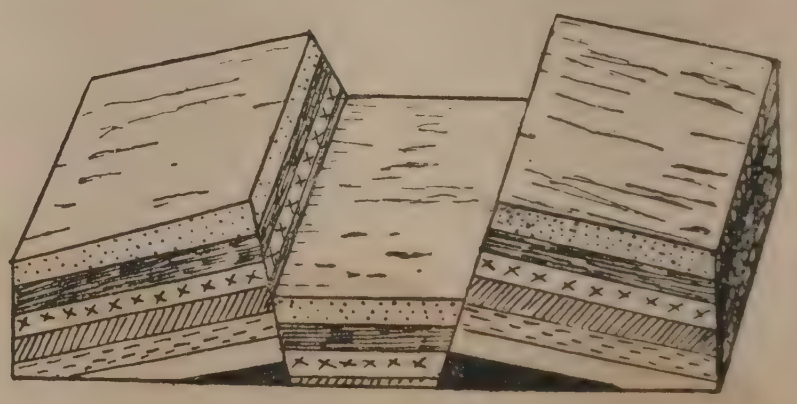

FIG. 86

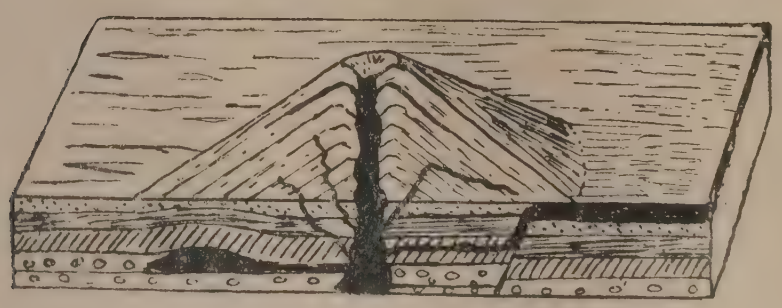

FIG. 87.

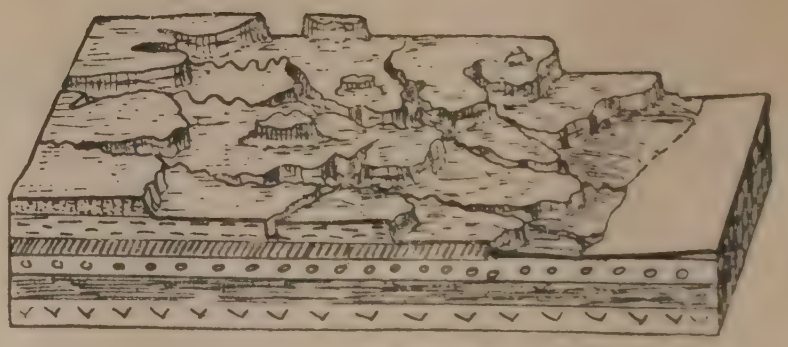

FIG. 88.

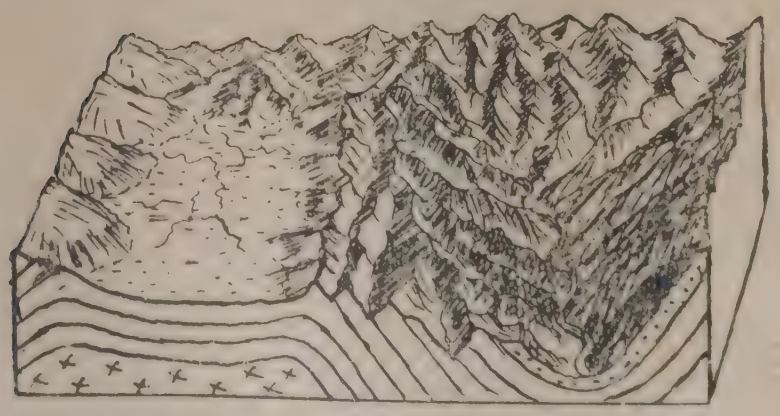

FIG. 89

FIG. 90

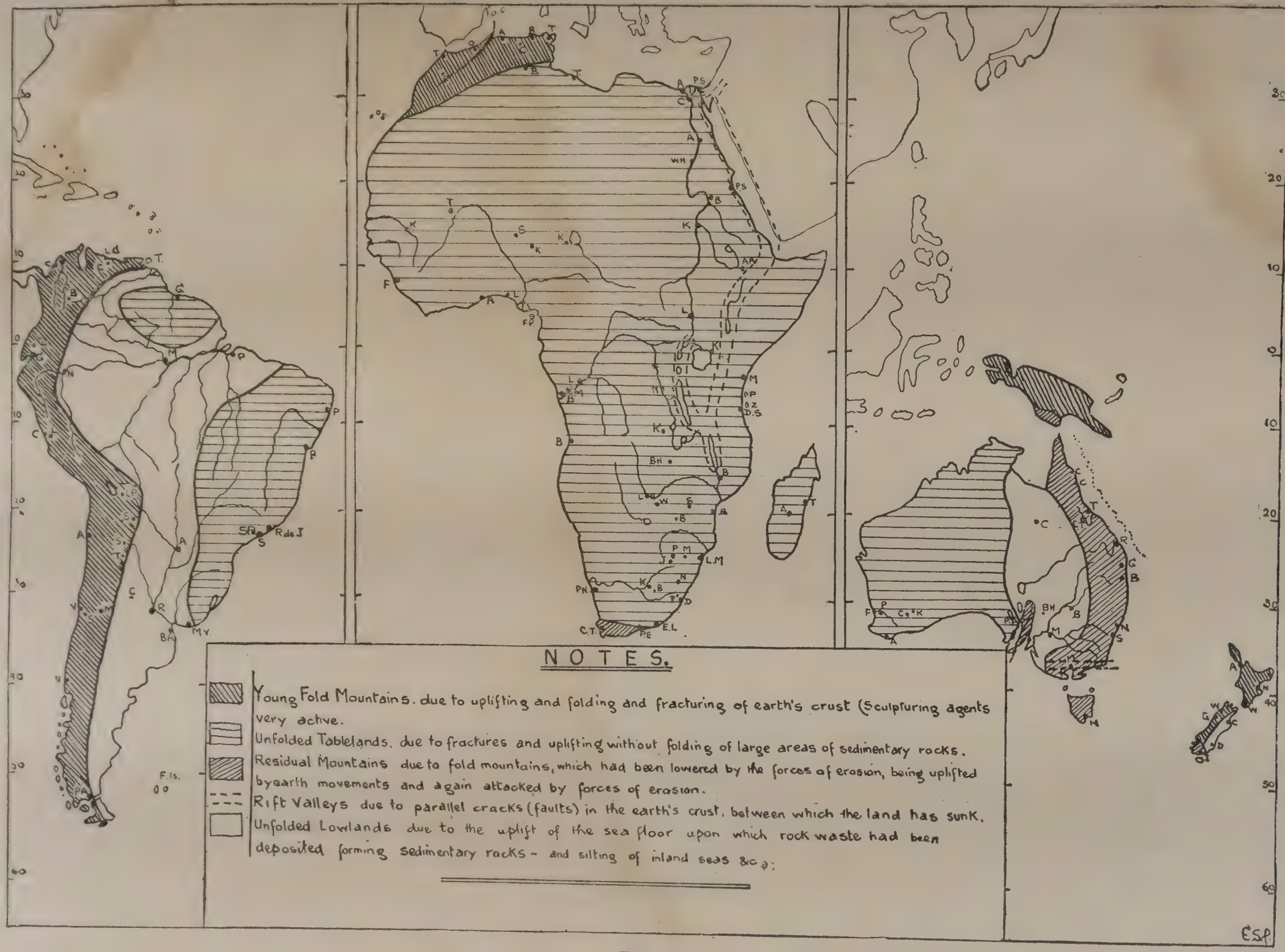
NOTES.
Young Fold Mountains. due to uplifting and folding and fracturing of earth's crust (Sculpturing agents very active.
Unfolded Tablelands. due to fractures and uplifting without folding of large areas of sedimentary rocks.
Residual Mountains due to fold mountains, which had been lowered by the forces of erosion, being uplifted byearth movements and again attacked by forces of erosion.
Rift Valleys due to parallel cracks (faults) in the earth's crust, between which the land has sunk.
Unfolded Lowlands due to the uplift of the sea floor upon which rock waste had been deposited forming sedimentary rocks - and silting of inland seas &c.
Esp

FIG. 91.

folding, the strata break and one side of the fractured layers sinks along the line of fracture, forming a **fault** (Fig. 85). (*h*) Where a portion of the earth's crust sinks down between two faults, a **rift valley** is formed (Fig. 86). (*i*) Elevated masses bordered by faults are called **block mountains** (Fig. 85). (*j*) Molten rock material from the interior of the earth sometimes rises along fault lines and flows over the surface of the land. This molten material is called **lava.** (*k*) Some of the material may be ejected violently to the surface, forming a **volcano** (Fig. 87). (*l*) Some, again, may be squeezed into the arches beneath upfolds of the strata, where it cools to form **granite** (Fig. 83). Granite and lava are **igneous** rocks.

13. Draw enlarged copies of Figs. 81 to 87, and beneath each drawing write brief explanatory notes.

14. Fig. 91 shows the African Rift Valley. Mark the position of this valley on the map which you have drawn in answer to question 5. Notice also that Spencer Gulf and the Great Valley of Victoria (Australia) are also rift valleys.

***15.** In your study of the relief features of the three southern continents you have seen that there is a variety of land-forms in each of them. You also have noticed that the land-forms of one continent are repeated in the others. Fig. 91 shows the three southern continents roughly divided according to the **rock structure** (that is, the arrangement of the underlying rocks). Take each structural division in turn, and enter in your notebook (i) where it is found, (ii) the general characteristics of its relief features, (iii) the principal effects of its relief features upon the movements of man. Figs. 88 to 90 will be discussed later, but they may help you to answer (ii) and (iii) above.

At a later stage we shall deal with each land-form in detail; all that you need remember at this stage is that a similarity in the rock-structure tends to produce similar land-forms, which largely control the movements and life of man.

CHAPTER IX

LATITUDE, LONGITUDE, CLIMATE, DRAINAGE

G.D. 1. WHAT is the date of the longest day at Cairo, at Cape Town? Construct a diagram to find the approximate length of the longest day at Cairo from the following directions:

Draw a circle of 2 ins. radius and draw the diameters A B and C D at right angles to each other (Fig. 92). Construct the angle B O E equal to $66\frac{1}{2}$ degrees, and produce E O to F.

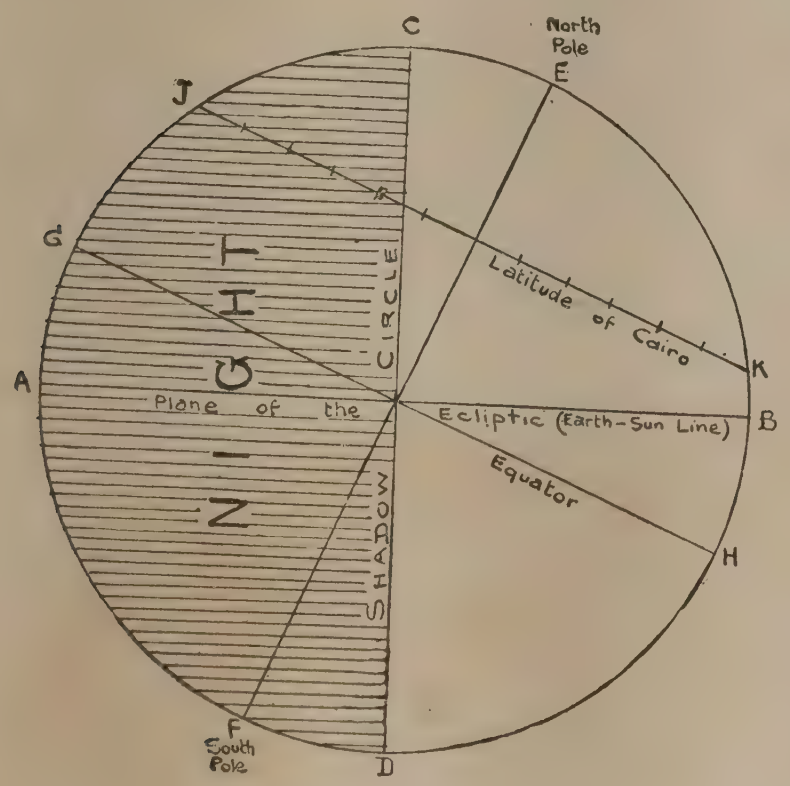

FIG. 92.

Draw G O H at right angles to E O F. Construct the angle H O K equal to the latitude of Cairo, and through K draw K J parallel to G H. Divide J K into twelve equal parts. Shade the semicircle C A D to represent night. Explain (*a*) why each division of J K represents two hours, (*b*) why the angle B O E must be $66\frac{1}{2}$ degrees.

G.D. 2. In the same way find the approximate length of the longest day at your school. What is the meaning of (*a*) solstice, (*b*) equinox, (*c*) plane of the ecliptic?

3. Write down the names of the towns in Africa which correspond most nearly in latitude to the following Australian towns: Brisbane, Charters Towers, Sydney, Newcastle.

4. Use Fig. 3 to find at what date the noonday sun is in the zenith at Lagos, Nairobi, Salisbury, Khartum, and Freetown.

5. What is the time (*a*) at Durban when it is noon at Greenwich; (*b*) at Cape Town when it is noon at Rosario; (*c*) at Valparaiso when it is noon at Mombasa? Use your model to check your answers.

6. Draw graphs to show the mean monthly temperatures of Cairo (lat. 30° N.) and Durban (lat. 30° S.), from the statistics given in question 8. Arrange your work on squared paper so that the graphs can be easily compared. Explain why it is hottest in Cairo during that period of the year when it is coldest in Durban.

7. The actual temperature over most of South Africa is at least 10 degrees lower than that shown on a temperature map. Examine the temperature maps (Figs. 93 and 94) and estimate the sea-level temperatures of Johannesburg (5,735 ft.), Salisbury (4,880 ft.), Mont aux Sources (11,000 ft.), in mid-summer and in mid-winter. Find by calculation the approximate temperatures at each place, assuming the decrease in temperature with altitude to be constant and at the rate of 1° F. per 300 ft.

8. Each of the factors which affects the distribution of temperature over Africa is illustrated in one or other of the sets of tables (A, B, C, D, E) given on p. 52. Draw graphs for each set, and in each case find the stations on the map and say which factor is chiefly responsible for the difference in the temperatures of the two stations. Give reasons for your answers.

9. Explain how the shape and relief of Africa cause the influence of the sea to be confined to the coastal margins. How do the temperature maps (Figs. 93 and 94) show this? Say also how the maps show the influence of cold currents. Name the two cold currents which affect the west coast of Africa.

10. Why has the Red Sea more influence on the isotherms in July than in January?

11. Write an account of the distribution of temperature over Africa. Use your answer to question 8, Chapter V, as a model.

(In answering questions of this type, avoid vague expressions. As far as possible use the names given in your atlas when describing the

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—	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
A. Durban	77	77	74	72	68	66	65	67	68	70	73	75
Port Nolloth	60	60	60	59	58	55	54	53	55	58	58	59
B. Cairo	54	58	62	69	76	81	83	82	78	74	65	58
Wadi Halfa	61	67	73	81	87	91	93	91	87	83	71	65
C. Durban	77	77	74	72	68	66	65	67	68	70	73	75
Pietermaritzburg (2,218 ft.)	72	72	70	65	59	55	55	60	65	66	69	70
D. Durban	77	77	74	72	68	66	65	67	68	70	73	75
Kimberley (reduced to sea-level)	78	78	72	65	57	53	52	56	64	69	73	76
E. Dar-es-Salaam	82	82	80	79	77	74	74	74	75	77	80	82
Durban	77	77	74	72	68	66	65	67	68	70	73	75

geographical conditions of the different parts of a country or continent.)

12. Copy the coast outline of Figs. 96 and 97 and insert the parallels of latitude and meridian 20° E. With the help of Figs. 43 and 44 shade or colour each map to show the wet and dry belts as they affect Africa west of long. 20° E. only.

13. Compare your maps with the seasonal rainfall maps (Figs. 96 and 97). Explain why the winter rains of North Africa do not extend beyond the Atlas region, and describe and account for the distribution of rainfall over Africa west of long. 20° E.

14. The rainfall conditions in the east of Australia differ from those in the west between the same latitudes. If this is true of Africa south of the equator, explain the physical causes of it.

15. Study the rainfall maps of Africa (Figs. 95-97) and explain why (*a*) in the northern winter the east coast receives little or no rain from the north-east trade-winds; (*b*) in the southern winter only a small part of the east coast receives rain from the south-east trade-winds; (*c*) in the northern summer the wet equatorial belt does not extend across the continent; (*d*) in the southern summer all the east, south of the "Eastern Horn of Africa," receives rain.

16. With the help of your atlas and Figs. 96 and 97 describe and account for the distribution of rainfall in Madagascar.

17. What parts of Africa receive rain (*a*) in summer only, (*b*) in winter only, (*c*) in all seasons, (*d*) in no season. Tabulate your answers. (Remember that it is summer north of the equator when it is winter south of it.)

18. Describe the rainfall conditions of (*a*) Nigeria, (*b*) British South Africa, (*c*) Anglo-Egyptian Sudan, (*d*) Kenya Colony and Tanganyika Territory.

P. 19. What is meant by radiation? Explain why, in summer, cloudless days are usually warmer than cloudy days, whereas cloudless nights are usually colder than cloudy nights.

20. How does your answer to question 19 help to explain why there is a great daily range of temperature in desert regions.

P. 21. Closely examine the composition of a piece of granite or a piece of sandstone. Explain why a cold pebble suddenly heated and a hot pebble suddenly cooled usually crack and break.

22. Apply what you have learned in the preceding three exercises to the weathering of the rocks in desert regions. In which wind belts do the deserts of Africa and Australia lie? How do the winds help to wear away the standing rocks and to reduce the larger rock fragments to sand? Compare the action of wind with that of rivers in this respect.

23. Examine the temperature maps of Africa and Australia and state in which parts the highest temperatures are experienced. Read your answer to question 19, then explain why very high temperatures are not experienced in the wet equatorial belt.

24. Compare the relief map with the rainfall maps and explain why (*a*) almost all the rivers of Africa are subject to floods; (*b*) the Limpopo and Atbara almost dry up in winter; (*c*) the

FIG. 93

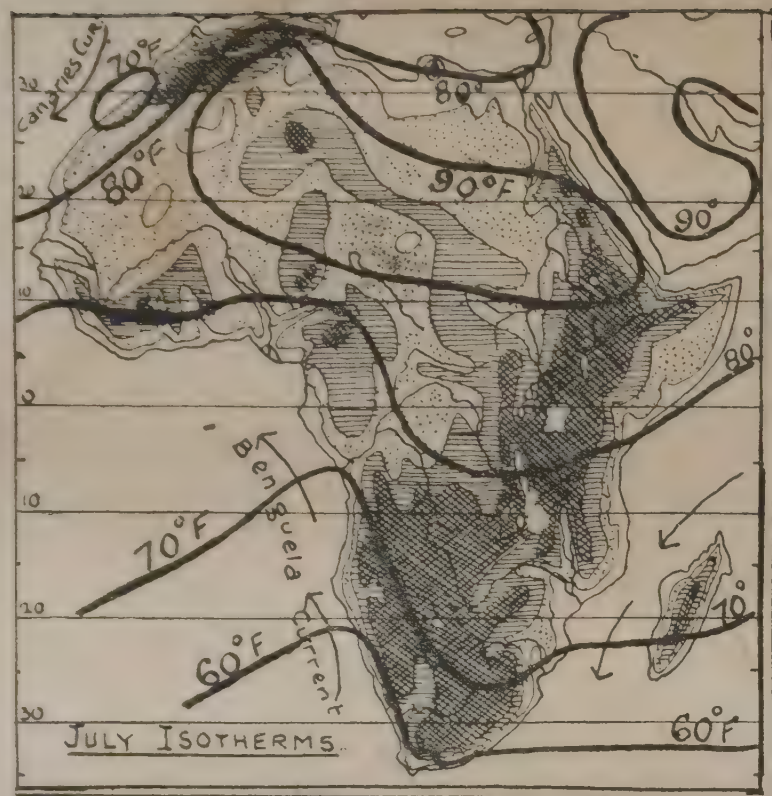
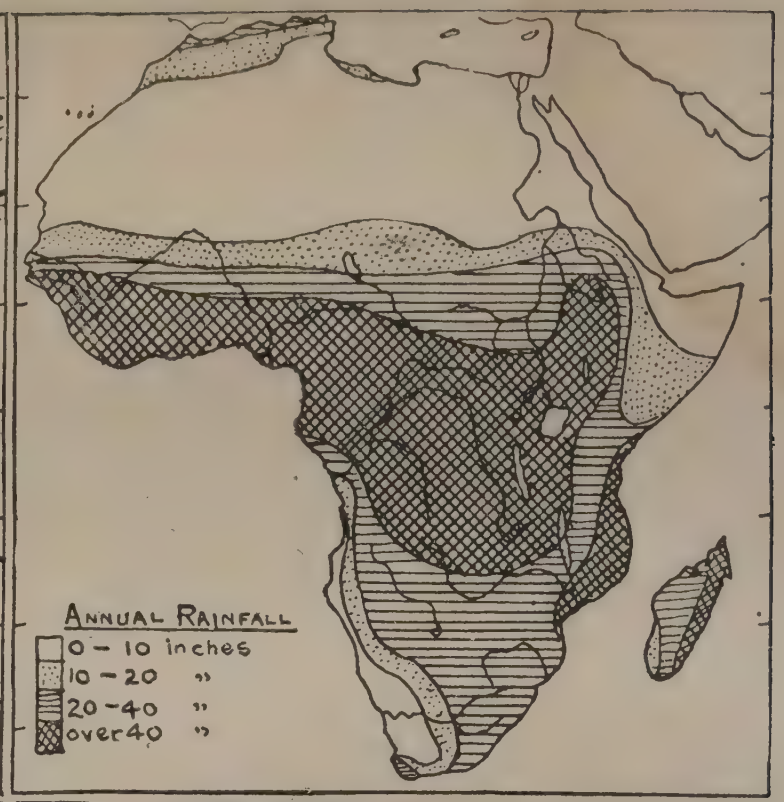


FIG. 94.

FIG. 95.



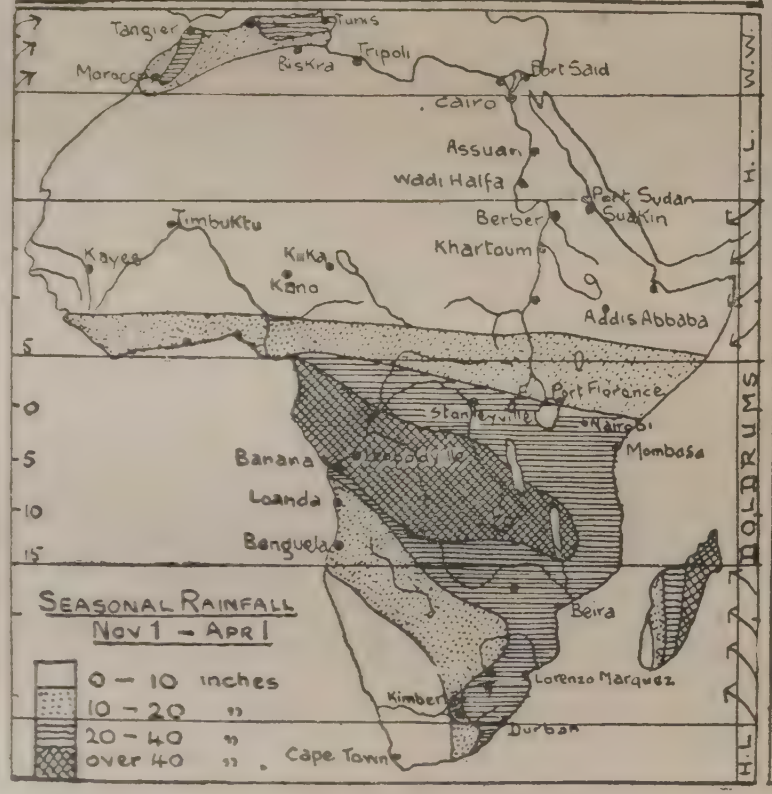


FIG. 96.

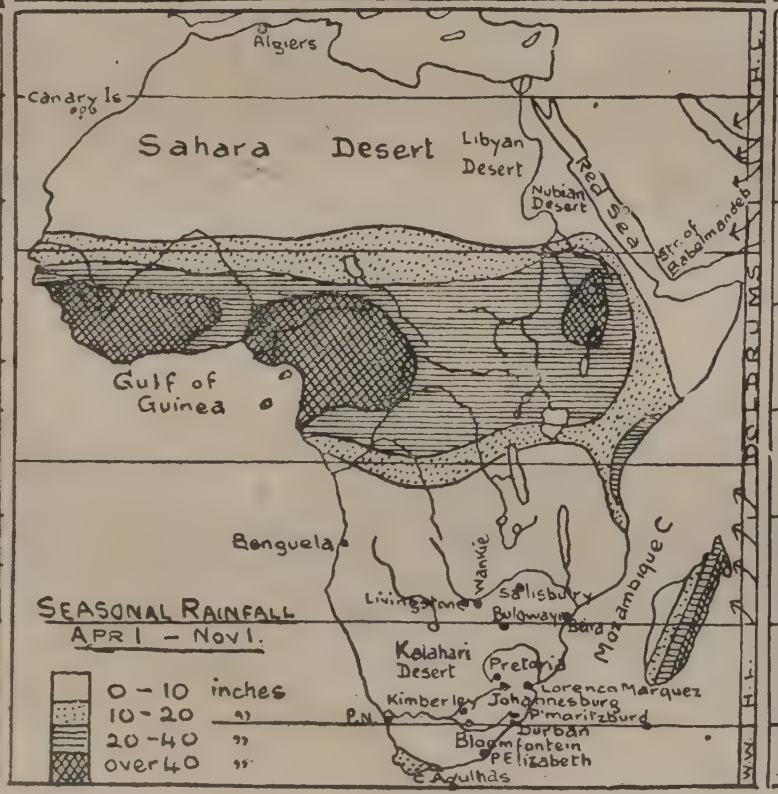


FIG. 97.

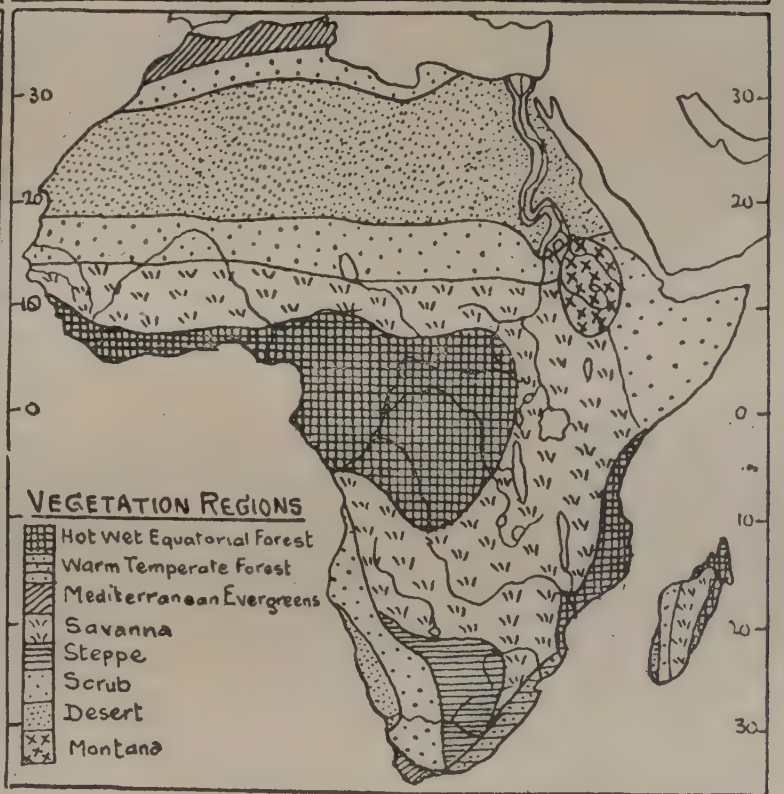
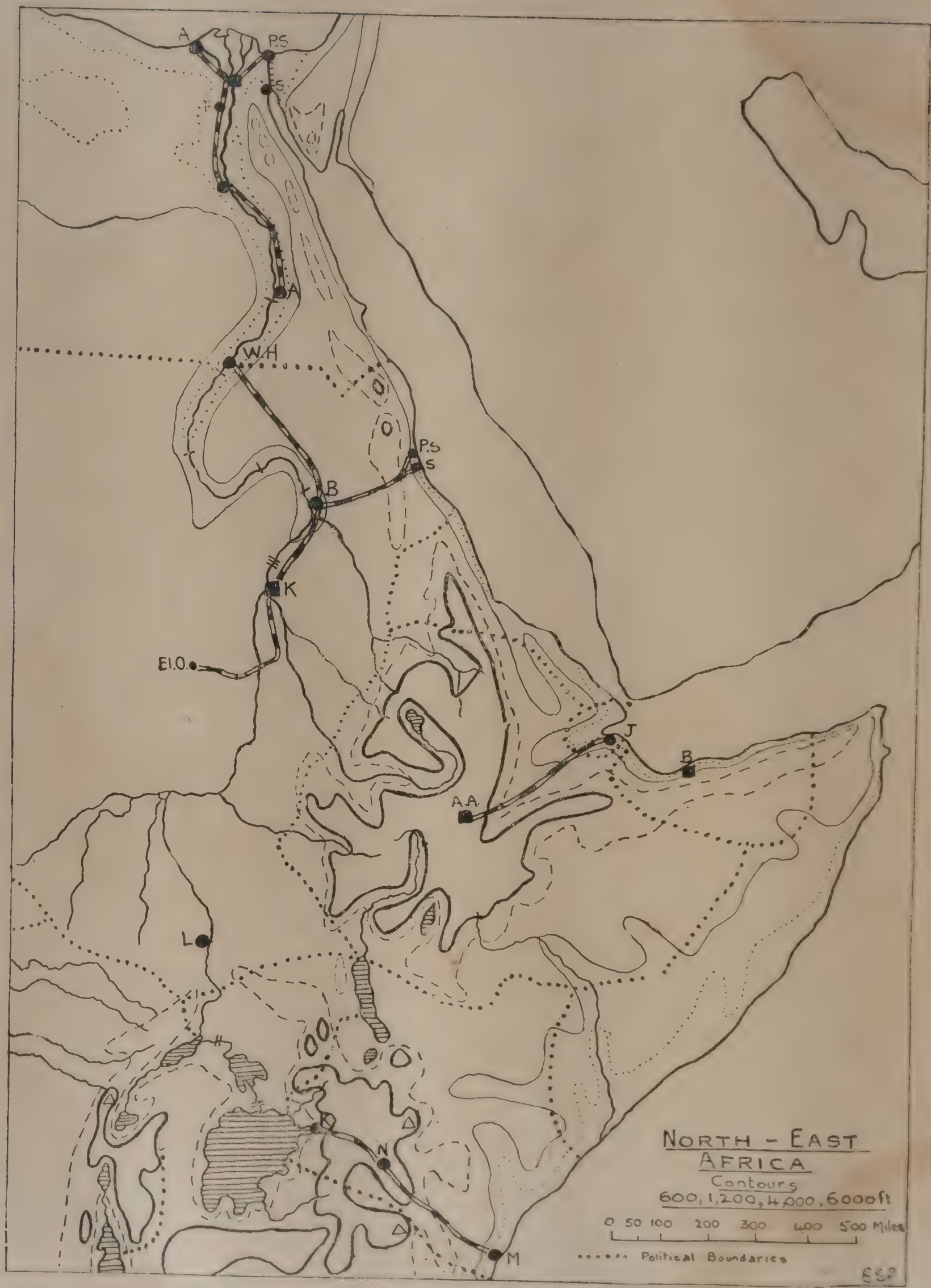


FIG. 98.


A
P.S
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A
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J
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AA
L
N
M
NORTH - EAST
AFRICA
Contours
600, 1,200, 4,000, 6000ft
0 50 100 200 300 400 500 Miles
Political Boundaries
ESP

FIG. 99.

Congo varies least in volume; (*d*) the Benue has a greater volume of water than the Niger in summer; (*e*) the Nile has no permanent tributaries between Berber and the sea.

G.D. 25. Draw straight lines to the same scale to represent the lengths of the following rivers: Nile (3,670 miles), Niger (2,600), Benue (900), Zambesi (1,600), Orange (1,000), Senegal (1,000), Amazon (3,400), Congo (2,800), Orinoco (1,550), Uruguay (930), San Francisco (1,800), Magdalena (1,000), Parana (2,400), Murray (1,100). Arrange them in order of length for the separate continents. Measure on your atlas the approximate distance in a straight line between the source and mouth in each case.

26. Draw a map of Africa to show the courses of the African rivers named in question 25. Mark the positions of the waterfalls (see Fig. 77).

27. Explain why (*a*) the course of every African river is interrupted by waterfalls, (*b*) there are deep gorges below many of the waterfalls.

28. Copy into your notebook the following description of the course of the Nile. Insert and underline the omitted words:

The headstream of the Nile flows north to Nyanza. The several streams which flow into this lake are fed by constant rains, so that the Nile is provided with a permanent supply of water from this region. On leaving Nyanza the course of the Nile is interrupted by waterfalls. After passing through a small marshy lake, the river descends from the plateau into Lake , situated in the rift valley. The volume of the Nile is greatly increased by the addition of water from the rift valley. Near the Nile descends from the high plateau to the Sudan, and from this point to its junction with the Bahr-el-Ghazal the slope is so gentle that the river widens into vast swamps, where papyrus and other marsh plants form a dense mass of floating vegetation called the Sudd. The slope continues to be gentle until the swift from the Highlands enters the Nile at Khartum. Below Khartum the Nile Valley is only a few miles wide, and is bordered by high cliffs on either side, beyond which lies the desert. The last of its tributaries, the , enters on the right, a few miles to the south of Berber, at a distance of about miles from the sea. Between Khartum and the Nile is obstructed by six cataracts. These cataracts are not due to the river falling from terrace to terrace, as is the case with the other waterfalls, but to ridges of hard rock running across the river's course. At the Nile enters Egypt, and between this point and Aswan there are long stretches of the valley which are very narrow. At , 110 miles from the sea, the delta begins. In the delta the Nile divides into a large number of **distributaries,** the chief of which are the and the . The Nile floods are chiefly due to the heavy rains which fall on the Abyssinian Highlands from June to September.

29. Draw a map of the Nile basin (see Fig. 99). Insert the names used in your answer to question 28 and mark by means of appropriate signs and symbols all the other facts contained in the same answer.

30. With the help of your atlas and rainfall maps write similar accounts of the Niger, Congo, Zambesi, and Orange Rivers, and draw a map to accompany each account. Embody in your accounts the following facts as well as those to be found in Chapter XI, question 9:

Niger.—Rises in the Futa Jallon Highlands—its delta extends for 250 miles along the coast—the area of the delta is almost twice the size of Wales.

Congo.—Carries more water to the sea than all the other African rivers put together—below Livingstone Falls it flows in a forested gorge—60 miles from the sea it is 12 miles wide.

Zambesi.—Victoria Falls are 400 ft. high and the gorge below the falls is 400 ft. wide—above the falls the river is a mile wide—the varying volume of the river causes its height to vary 40 ft. in the gorge.

Orange.—Most of its course lies in a deep trench—it is a raging torrent in the wet season—its course is interrupted by waterfalls and rapids.

31. Find on the map of Africa three areas of inland drainage and name the lakes which receive the drainage waters of these areas. Which African lakes lie (*a*) in the rift valley, (*b*) on the plateau? What difference do you notice in the shape of these two classes of lakes? Draw Lakes Victoria, Tanganyika, and Nyasa to the same scale on squared paper, and in the case of each lake find its approximate area, greatest length, and greatest breadth.

CHAPTER X

VEGETATION, ANIMALS

1. COMPARE the vegetation map of Africa (Fig. 98) with the climatic maps and find whether the climatic conditions of the different vegetation regions resemble those of similarly named regions in South America (see Chapter VI, question 9).

2. Explain why there is no cool temperate forest region in Africa.

3. Neither in Africa nor in South America do the hot wet forests extend right across the continent. Explain how the relief is directly responsible for this.

***4.** Write short notes describing the characteristic vegetation of each of the regions marked on the map, and give the meaning of esparto, papyrus, sudd.

***5.** Describe the position and the vegetation of (*a*) the High Veld, (*b*) the Great Karroo, (*c*) the Little Karroo, (*d*) the Plateau of the Shotts, (*e*) the Tell, (*f*) Abyssinia.

6. Fig. 100 shows the distribution of the most important vegetable products of Africa and the boundaries of the vegetation regions of Fig. 98. Tabulate the products of each vegetation region.

***7.** Compare your table with that given in Chapter VI, question 9, then name and write notes on the products which appear only in the African table.

8. Place a tracing of the outline and political boundaries of Africa (Fig. 77) over the productions map (Fig. 100) and draw up a table showing the vegetation regions and vegetable products of (*a*) Nigeria, (*b*) Union of South Africa, (*c*) Anglo-Egyptian Sudan, (*d*) Barbary States, (*e*) Uganda and Kenya Colony, (*f*) Rhodesia, (*g*) Belgian Congo, (*h*) Egypt. Name the Barbary States.

9. You have seen that in South America and in Australia farming is a business carried on or controlled by Europeans or their descendants, who grow crops and rear animals for the markets of the world. There are only about 2 million people of European origin in the whole of Africa, whereas the native population exceeds 150 millions. On the whole, the natives of Africa are in a state of tribal barbarism, and, with few exceptions, grow crops to supply only their own needs. From the Sudan to the Zambesi this work is performed almost wholly by women, for the men spend most of their time in hunting and guarding their cattle. A number of the natives are employed in collecting the products of the hot wet forests for European traders, and some are employed on the plantations of East and West Africa. In South Africa, where most of the Europeans live, native farm labour is not satisfactory, and Hindus are employed on the plantations of Natal.

Name the chief products (*a*) collected, (*b*) cultivated by the natives in the hot wet forest region of West Africa.

10. In 1919 the Union of South Africa produced:

	Wheat.	Maize.	Tobacco.
	1,000 lbs.	1,000 lbs.	1,000 lbs.
Cape Province	323,734	663,070	4,776
Natal . .	2,154	220,746	614
Transvaal .	65,504	823,398	8,122
Orange Free State . .	87,342	612,394	671

In addition Natal produced 150,000 tons of sugar and 5,744,000 lbs. of tea.

Write a brief summary of the facts established by the above figures.

A. 11. In 1919 Australia produced:

Wheat.	Maize.	Sugar.
1,000 bushels.	1,000 bushels.	1,000 tons.
75,638	6,912	1,780

Find, in bushels, the total amount of wheat and maize grown in the Union of South Africa, assuming that 60 lbs. are equal to one bushel.

G.D. 12. Draw a series of rectangles to represent the above totals graphically.

13. Compare the agricultural products of Natal and Cape Colony with those of New South Wales and Victoria, and account for any similarities and any differences.

14. In the case of Australia you found that grain crops could not be grown successfully without irrigation, where the annual rainfall was less than 20 ins. Draw a map of South Africa to show the area with an annual rainfall of less than 20 ins. Explain why irrigation works are found in the Little Karroo.

15. With the help of the rainfall and productions maps find the regions in North Africa where crops are grown by irrigation. Name the regions and the crops.

16. The physical conditions of Egypt are exceptional and require special notice. Use your climatic and vegetation maps to complete the following table:

—	Average Jan. temp.	Average July temp.	Annual rainfall.	Vegetation region.
Lower Egypt (i.e. the Delta)				
Upper Egypt				

Although Egypt receives practically no rain, yet we find that in 1919 the Nile Valley of Egypt, with an area of 12,226 sq. miles (a little over one and a half times the area of Wales), produced almost sufficient food to feed its—

12,878,000 inhabitants,
500,000 cattle,
500,000 buffaloes,
600,000 donkeys and asses,

besides growing 48,000,000 lbs. of cotton, of which £65,500,000 worth was exported. The Nile Valley of Egypt has no minerals, except building stone (the mineral resources of Egypt are in its otherwise barren deserts), no forests, no natural grasslands, no fuel for manufactures. It is purely agricultural, and its prosperity depends entirely on the annual floods of the River Nile.

***17.** Write notes on the work of the British engineers in Egypt, and show how the increased productivity of the land is largely due to the British. Explain what is meant by flood irrigation and perennial irrigation; state the advantages and disadvantages of each method.

18. Compare the mean July temperature of your school town with the mean January temperature of Egypt, then state which of the following Egyptian products you consider can be grown in winter in Egypt: cotton, maize, wheat, rice, beans, barley, sugar, clover, onions, fruit.

19. Name other countries in Africa where cotton growing is important (see Fig. 100). Why is cotton one of the most important of the world's crops?

Animals

***20.** Africa is the home of innumerable wild animals, and Central Africa is the most important hunting-ground in the world.

Name the chief wild animals of Africa, and state the chief vegetation regions with which each is associated.

***21.** Write brief notes on the distribution and characteristics of the camel, ostrich, elephant, and tsetse fly, and state how each of them affects the activities of man in the regions in which it is found.

G.D. 22. The following table gives the numbers of domestic animals in the Union of South Africa and in Australia in 1920:

—	Cape Province.	Natal.	Transvaal.	Orange Free State.	Australia.
Cattle	1,630,000	730,000	1,550,000	1,660,000	11,390,000
Sheep	15,400,000	1,300,000	3,250,000	8,600,000	84,400,000
Goats	4,800,000	300,000	450,000	260,000	41,000
Ostriches	270,000	2,000	3,000	4,000	—
Pigs	300,000	70,000	180,000	160,000	970,000
Horses	280,000	50,000	110,000	260,000	2,440,000
Asses and mules	370,000	40,000	110,000	52,000	—

Construct diagrams to show the relative numbers in 1920 of cattle, sheep, and horses in the Union of South Africa and Australia.

***23.** Give some reasons explaining why cattle and horses are far more numerous in Australia than in South Africa.

24. Examine the productions map and state what animals are reared in (*a*) the Atlas region, (*b*) the Eastern Horn of Africa. In certain parts of the savanna lands of Africa the natives do not rear cattle. Why is this?

CHAPTER XI

MINERALS, COMMUNICATIONS, RACES, POPULATION

1. THERE is no doubt that Africa is rich in all kinds of minerals, but so far only gold and diamonds are mined to any extent. How do you account for this?

2. On an outline map of Africa mark the positions of the mining centres named in the lists below. Insert the initial letter of the mineral referred to, as well as the names of the towns. Represent coal by a small cross (see Fig. 100).

Coal . .	(Natal) Newcastle, Dundee; (Rhodesia) Wankie; (Transvaal) Middleburg; (Orange Free State) Kroonstad; (Cape Province) Indwe; (Nigeria) Udi.
Copper .	(Cape Province) Ookiep; (Belgian Congo) Kambove in the Katanga district; (Rhodesia) Kafue; (S.W. Protectorate) Grootfontein.
Lead and zinc	(Rhodesia) Broken Hill.
Tin . .	(Nigeria) Bauchi.
Diamonds .	(Cape Province) Kimberley; (Orange Free State) Jagersfontein; (Transvaal) Premier Mine, near Pretoria.
Gold . .	(Transvaal) Johannesburg; (Rhodesia) Bulawayo and Salisbury; (Gold Coast) Takwa

3. The value of the mineral output of the Union of South Africa and Australia for 1918 is given below:

—	Union of South Africa.	Australia.
Gold . . .	£35,759,000	£5,408,000
Diamonds . .	£7,115,000	—
Silver and lead .	£189,000	£6,105,000
Copper . .	£342,000	£4,465,000
Tin . . .	£441,000	£1,432,000
Coal . . .	£3,225,000	£6,124,000

Complete the following statement in your notebook:

In 1918 produced times the amount of silver, times the amount of copper, and times the amount of tin that was produced in ; but produced times the amount of gold that was produced in .

***4.** Write short notes on the gold mines of Johannesburg and diamond-mines of Kimberley.

5. Mark on the map which you have drawn in answer to question 2, the railways and ports which serve the mineral centres (see Fig. 77).

***6.** Mark on the same map the other railways shown in Fig. 77, and in each case say why the railway was constructed.

7. Although railways are fairly numerous in British and French Africa, the chief means of transport over most of Africa are (*a*) the ox-wagon from the Cape to the Zambesi, (*b*) canoes and human porters from the Zambesi to the Sudan, (*c*) the camel from the Sudan to the Mediterranean coast. Explain why (1) the horse is not important in the first-named region, (2) the ox and camel give place to the human being in the second region, (3) the camel is the chief transport animal in the third region. State what special physical feature makes the canoe so important in (*b*).

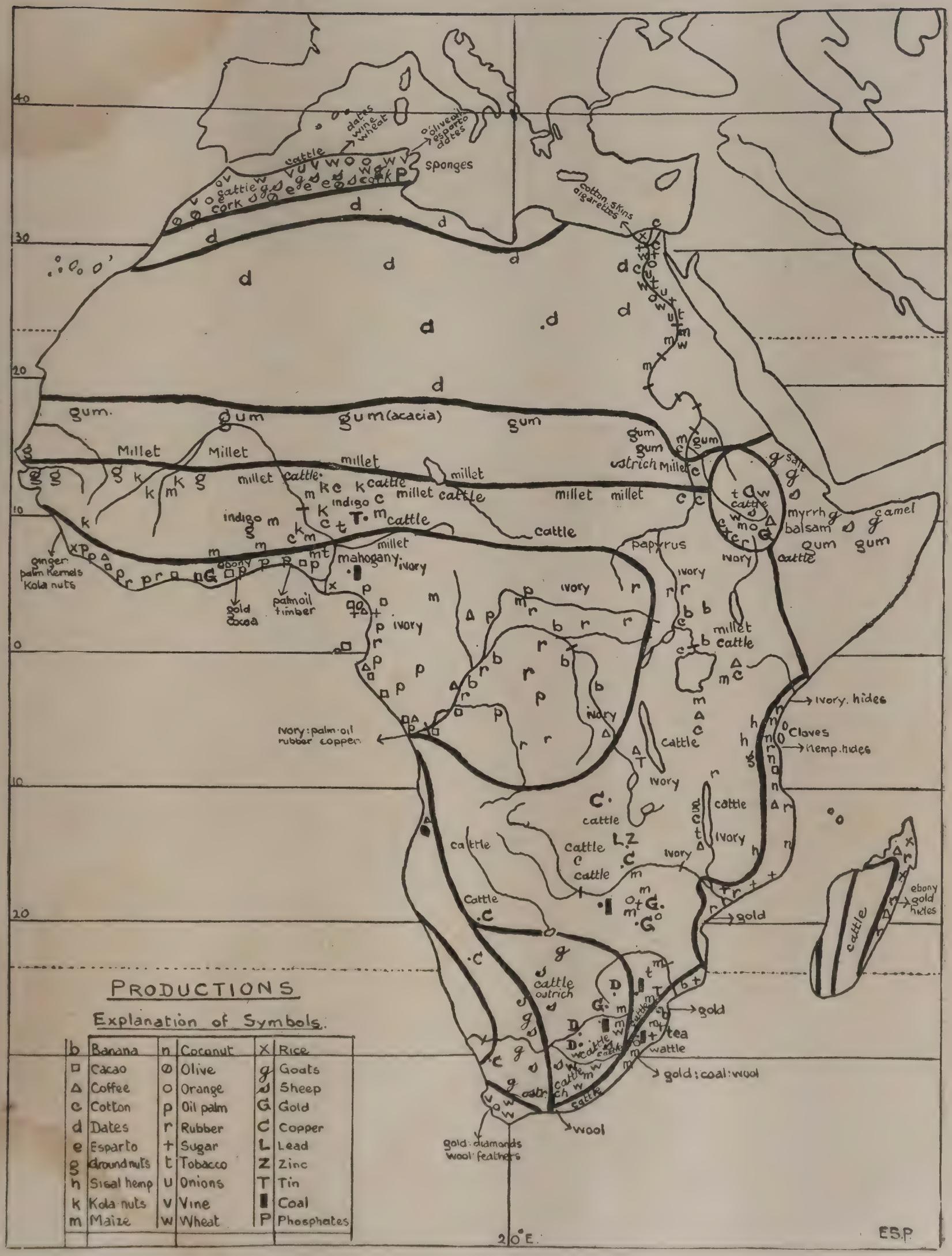
8. Although caravans still cross the Sahara, the total value of the trade which is carried on in this way is relatively small. Write notes on the character of this trade, and draw a map of North Africa to show the chief caravan routes and market centres (see Fig. 77). What geographical conditions control the direction of these routes? How has the construction of a railway from the Senegal River to the Niger affected the caravan trade from Timbuktu?

9. The River **Nile** is navigable from the sea to Wadi Halfa and from Berber to Lado; the **Niger** from the sea to Rabba and from Timbuktu to Koulikoro; the **Benue** for 600 miles; the **Congo** from the sea to Matadi, then 200 miles of unnavigable rapids to Stanley Pool, from where there are over 1,000 miles of navigable water to Stanley Falls; from above the falls there are nearly 600 miles more navigable water in two sections, (i) from Ponthierville to Kindu and (ii) from Kongolo to Bukama in Katanga; the **Senegal** from the sea to Kayes; the **Zambesi** from the sea to above Tete; the **Shire** throughout its length except at the falls. Draw a map to show the navigable portions of the above-named rivers.

***10.** Write short notes on the Suez Canal and the importance of this route to Britain.

11. Draw up a table to show the ports of Africa and their chief exports (see Fig. 100).

Hy. 12. Briefly outline the social condition of your home district, or of Britain, from the



PRODUCTIONS

Explanation of Symbols.

b	Banana	n	Coconut	X	Rice
□	Cacao	⌀	Olive	g	Goats
△	Coffee	o	Orange	s	Sheep
c	Cotton	p	Oil palm	G	Gold
d	Dates	r	Rubber	C	Copper
e	Esparto	+	Sugar	L	Lead
g	Groundnuts	t	Tobacco	Z	Zinc
h	Sisal hemp	u	Onions	T	Tin
k	Kola nuts	v	Vine	▮	Coal
m	Maize	w	Wheat	P	Phosphates

ESP

FIG. 100.

FIG. 102.

FIG. 101.

earliest times to the present day, so as to illustrate the truth of the following statement: "The use that is made of a land and its resources depends not only on its physical conditions but also on the people who occupy it."

13. Illustrate the truth of the above statement from what you know of the use made of the land and resources of South America and of Australia (*a*) by the natives, (*b*) by Europeans.

14. You have seen (*a*) that the way in which the natives of South America and Australia live is largely controlled by their physical surroundings, and that their physical surroundings have helped to make them what they are, (*b*) that contact with a more advanced people has, in New Zealand, resulted in an improvement in the life of an intelligent native population.

Illustrate the first of the above statements from the life of the Indians of the Amazon forest or the natives of Australia, and the second statement from the life of the Maoris.

***15.** Write a brief account of the chief native races of Africa (Fig. 101). Draw up a table to show where each race is found.

***16.** Describe the life of the following peoples to illustrate the truth of the statements contained in questions 12 and 14:

(*a*) The Pigmies of the Congo Forest; (*b*) the Fan negroes of West Africa; (*c*) the Basutos or Zulus of South Africa; (*d*) the Hausa tribes of the Sudan; (*e*) the Arabs of the Sahara and its oases.

***17.** Say what you know of the Boers.

***18.** In which parts of Africa are most Europeans to be found? What are the chief occupations of the British in (*a*) West Africa, (*b*) Uganda and Kenya Colony, (*c*) Rhodesia, (*d*) Union of South Africa.

19. Examine the population map (Fig. 102). Name the regions of dense population and the regions which support few or no people.

20.

POPULATION OF THE UNION OF SOUTH AFRICA

Province.	Coloured (1921)	White (1921)	Area in sq. miles.
Cape Province	2,132,110	650,609	276,966
Natal . .	1,292,660	136,838	35,291
Transvaal .	1,544,151	543,485	110,450
Orange Free State . .	440,271	188,556	50,389
S.W. Protectorate . .	208,000	19,432	322,400

Find the density of population per square mile, also the number of whites per square mile, in each province.

21. Account for the patches of concentrated population which are marked on the map in South Africa.

22. Explain (*a*) why the desert areas of Africa are not entirely destitute; (*b*) why the savanna lands and Congo basin of Africa have a denser native population than the savanna lands and Amazon basin of South America respectively; (*c*) why Nigeria has a comparatively dense native population.

23. Explain how the geographical conditions have, from the earliest times, encouraged the development of a prosperous agricultural population in Egypt.

24. Although the distribution of population cannot be explained entirely by reference to physical conditions and resources, there is, you have noticed, a close connection between occupations and the density of population. For instance, the Spaniards who discovered America found on the plateau of Peru a large native population cultivating the land and rearing animals, while on the lowlands they found only a few backward tribes living by hunting and gathering roots and fruits. Again, the exercises based on the population maps and on the 1-inch map of the Ruabon district have shown the same intimate connection between the occupations of a region and the density of its population. A summary of your conclusions is given below:

Occupation.	Population.
1. Hunting and collecting . .	Very sparse.
2. Pastoral . .	Sparse to moderate.
3. Agricultural . .	Moderate to dense.
4. Mixed farming .	Dense.
5. Intensive horticulture and agriculture.	Very dense often over large areas.
6. Mining, manufacturing, commerce.	Extremely dense and usually in small patches.

Expand the above summary into an essay. Include in your essay illustrative examples drawn from your home district and from the three southern continents.

25. Analyse carefully the sites of six of the chief towns or cities of Africa so as to bring out the geographical facts which account for their position and development. Draw sketch maps to show the facts mentioned in your answers.

CHAPTER XII

POLITICAL DIVISIONS, HISTORY, ISLANDS, AND REVISION

1. SOME of the oldest monuments of civilisation are to be found in North Africa. Name some of them, and state where they are situated.

2. Although the coastal regions of Africa had been explored before Columbus discovered America, very little was known of the interior of the continent up to fifty years ago. Some of the reasons given for this are: (*a*) The coast is bordered either by uninviting deserts or by dense unhealthy forests; (*b*) the surf-beaten and swampy shores of a monotonous unbroken coast offer very few good harbours for landing; (*c*) the rivers of South America form the best routes into the interior, but in Africa all the rivers have rapids and waterfalls, and vary greatly in volume from season to season. Many of them flow, during much of their course, in densely forested gorges; (*d*) the climate, except at the extreme north and extreme south of the continent, is unsuited for Europeans; (*e*) the natives were, and in some places still are, hostile.

Give examples to support each of the above statements.

Hy. 3. Explain (*a*) what led to the Crusades, (*b*) how the Crusades caused Western Europe to take an interest in extra-European regions; and give reasons, other than religious reasons, for the support given to the Crusades by traders.

Hy. 4. Soon after 1450 the Ottoman Turks overran the whole of the eastern shores of the Mediterranean. Why did this historical fact lead to the exploration of the coastlands of Africa, and which coast in particular? What was the aim of the explorers?

***5.** Refer to the school library for first-hand accounts of the great explorers of the interior of Africa. Insert on an outline map of Africa the routes followed by these explorers.

6. The accounts of travellers made it known that there were plateaus in the interior of Africa where the climate was cooler and healthier than on the coast. This led to the partition of Africa amongst European nations.

Copy the outline of Fig. 77 into your notebook. Mark on the map the political boundaries and the names of the chief countries and of their capitals. Colour the countries controlled by Europeans, using a different colour for each European nation, and give a list of the European nations concerned.

Which countries are left uncoloured? Explain why these three countries are independent.

7. With the exception of Madagascar all the islands which lie off the coast of Africa are small. Find the latitude and longitude and distance from the nearest point on the African coast of each island or group of islands named in the following table:

British	
Mauritius	Mountainous and very fertile—population 365,000, mostly Indians, Negroes, and French—chief produce is sugar.
St. Helena	Now unimportant—place of Napoleon's exile.
Ascension	Unimportant.
Seychelles	Mostly uninhabited—chief products coconut and vanilla.
Zanzibar and Pemba	Fertile—population 200,000—almost all Zanzibar is cultivated—chief produce cloves and copra—Zanzibar is an important collecting centre for East Africa.
French	
Comoro Is.	Small and unimportant.
Madagascar	Twice area of British Isles—plateau structure like most of Africa—a ridge 10,000 ft. high runs from N. to S.—its climate, etc., have already been noticed—population over 3,500,000.
Réunion	Rich in coffee and sugar plantations.
Portuguese	
Madeira	Genial climate—invalid resort—produces excellent grapes—Funchal is the chief town.
Azores	Produce pineapples and Mediterranean fruits—cattle are reared.
Cape Verde Is.	St. Vincent is the chief island and is a coaling station—the islands suffer from drought.
St. Thomas	Very fertile—grows large quantities of cacao.
Spanish	
Fernando Po	A densely forested volcanic island.
Canary Is.	Teneriffe peak, 12,000 ft. high—Las Palmas is a coaling-station—grapes, tomatoes, and bananas are grown.

8. Copy Fig. 78 into your notebook. Colour your map to show relief. Enter the names of the towns whose positions are indicated. Show the products of each country by means of letters and symbols as marked on the productions map (Fig. 100).

9. Write a short summary of the geography of the region represented in the figure, under the heads given in Chapter VII, question 26. Embody the following additional notes in your summary:

Most of **Morocco** has been a French Protectorate since 1912. The country is in a very backward state. In the oasis of Tafilet there are 500 sq. miles in dates. Parts of Morocco are controlled by Spain.

Algeria is a French colony. Constantine is a grain market, but both Oran and Algiers are larger.

Tunis is a French Protectorate.

10. Apply questions 8 and 9 to Fig. 79. Insert the following notes in your summary:

West Africa.—The vegetable oils and fats of this region are essential to West European peoples, although of no great value to the native population.

Nigeria.—Kano is a great market centre. Its industries include cotton goods dyed indigo blue and worn by the natives all over North Africa, metal, pottery, leather. Its city walls, 15 miles in circuit, enclose fields, gardens, and mud huts. Excellent coal is mined at Udi, and there are valuable tin deposits in the Bauchi plateau.

Sokoto, a city of mud huts enclosed by a wall 40 feet high, is the chief centre of Mahometanism in West Sudan. The Hausa tribes are energetic and skilful farmers. Cotton growing is being developed.

Sierra Leone.—The coastline is bordered by numerous sand bars. More than half the population is made up of liberated negroes. Freetown is the headquarters of the British forces in West Africa.

11. Apply questions 8 and 9 to Fig. 80. Insert the following notes in your summary:

Union of South Africa.—Ostriches are reared on the Little Karroo. Native labour is employed in the gold-mines. Cape Town has a population of 138,000, and is the chief port. The population of Natal includes 130,000 Indians. There are 20,000 Indians in Durban, the largest town, and the first seaport as regards trade.

12. Apply questions 8 and 9 to Fig. 99. Insert the following notes in your summary:

Egypt.—Since the British occupation in 1882 the population has practically doubled and the cultivable land has increased a hundredfold. One-quarter of our cotton supply is obtained from Egypt. There are 174,000 Europeans in Egypt, of whom 56,000 are Greeks, 40,000 Italians, 24,000 British, and 21,000 French. Cairo (791,000) is the largest city in Africa. Alexandria (445,000) is the second largest city.

Anglo-Egyptian Sudan.—The Sudan supplies most of the world's gum and ivory. The forests are rich in ebony. Cotton growing is being developed.

Uganda.—The climate is very unhealthy. Sleeping-sickness has been the scourge of the country, but it is steadily being conquered by medical science.

Kenya Colony, with a total population of nearly 3,000,000, has less than 10,000 Europeans. The climate around Nairobi, the capital, is suitable for Europeans. In the construction of the Uganda railway 20,000 Indians were employed. These have settled in the country. Mombasa (30,000) is the largest town.

Abyssinia.—The people of this country have been Christians from very early times. Farming and sheep rearing are the chief occupations of the people. The products of the lower zone (1,200–4,000 ft.) are sugar, cotton, coffee; of the middle zone (4,000–8,000 ft.), maize, wheat, tobacco, Mediterranean fruits, and cattle; of the upper zone (over 8,000 ft.), pastures for cattle, sheep, and goats.

13. During your long vacation make several copies of Fig. 91, omitting the structural divisions marked on the map. With the help of the maps contained in this book prepare a series of coloured maps to show (*a*) relief, (*b*) January temperature, (*c*) July temperature, (*d*) seasonal rainfall, (*e*) annual rainfall, (*f*) vegetation regions, (*g*) distribution of minerals, (*h*) distribution of population of the three southern continents.

R.B.A.N.M.

N.28

APPENDIX

28

THE books named below contain much suitable material in a handy form for the busy teacher. Reference is made to these books in the notes which follow.

Unstead and Taylor, *Regional and General Geography* (Philip).

Esson and Philip, *Map Reading made Easy* (Philip).

Herbertson, *Descriptive Geography, Africa* (Black).

Herbertson, *Descriptive Geography, Australia* (Black).

Newbigin, *Man and his Conquest of Nature* (Black).

The Australian Commonwealth (Arnold).

The New Zealand Colony (Arnold).

Tarr, *New Physical Geography* (Macmillan).

Much useful material is also to be found in recent numbers of the *Geographical Teacher* and in *Whitaker's Almanack*.

II. *Answers.*—(**2**) $\frac{1}{15840}$, $\frac{1}{21120}$, $\frac{1}{253440}$, $\frac{1}{633600}$, $\frac{1}{180}$. (**3**) 1 in. to 1 yd., 1 in. to 10 ft., 1 in. to 4 yds. (**4**) 6 ins. to 1 mile, 2 ins. to 1 mile, 25·344 ins. to 1 mile. (**5**) 4 miles, 704 yds. (**6**) 6 ins. to 1 mile. (**7**) 32 miles. (**9**) 400 miles nearly. (**11**) 465 yds. nearly. (**14**) 9 sq. yds. 6 sq. ft. 114 sq. ins., 6 sq. yds. 6 sq. ft. 3 sq. ins., 38,582 sq. yds. 3 sq. ft. (**15**) 30,976 sq. yds., 7,744 sq. yds. (**16**) 309,760 sq. yds., 860½ sq. yds. nearly, 495,616 sq. yds., 4,096 sq. miles. (**17**) 389,120 sq. miles. (**18**) 55⅓ acres. (**19**) 3 acres only.

III. See Esson and Philip.

IV. See Unstead and Taylor, Tarr.

V. **4.** See Herbertson, Arnold.

VI. **12, 13.** See Arnold, Encyclopædia.

VII. **22, 23, 25.** See Arnold, Herbertson.

VIII. **7.** See Herbertson.

VIII. **12.** See Unstead and Taylor, Tarr.

X. **4.** See Unstead and Taylor.

X. **5.** See Herbertson.

X. **20.** See Unstead and Taylor, Herbertson.

XI. **4, 10.** See Herbertson.

XI. **16.** See Herbertson, Newbigin.

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